OSPAR COMMISSION

Protecting and conserving the North-East Atlantic and its resources

Assessment of the discharges, spills and emissions from offshore installations on the United Kingdom Continental Shelf in 2012-2016

Offshore Industry Series

2018

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.

Assessment of discharges, spills and emissions from offshore oil and gas operations on the United Kingdom Continental Shelf, 2012 - 2016

Contents

Executive Summary

This report presents the discharge, spill and emission data for UK offshore oil and gas operations during the period 2012 – 2016 and provides an assessment of that data. The annual data on which the assessment is based is provided in Appendix 2.

Level of Activity

The United Kingdom Continental Shelf (UKCS) is a mature oil and gas province within the OSPAR region which has been experiencing declining production for many years, though there has been a significant increase over 2015 and 2016 due to start-up of significant new developments (Fig. 1). Oil and gas activity to maintain production levels and maximise economic recovery of reserves remains high including a notable upturn in the number of wells drilled (Fig. 3).

The total hydrocarbon production from the UKCS decreased by 9,5% during the period 2012 – 2014, but subsequently increased by 31% from 2014 to 2016. There has been a small decline in the total number of surface installations but a 9% increase in the number of subsea installations reflecting the ongoing trend in developing smaller fields tied back to existing hub installations (Fig. 2).

Discharges & Spills of Oil

The total quantity of dispersed[1] oil (aliphatic oil) discharged to the sea from produced water and displacement water decreased during the assessment period, from 2 267 tonnes in 2012 to 2 017 tonnes in 2016, a decrease of 11% (Fig. 5).

As in previous years, produced water and displacement water are the main contributors to the oil discharges from offshore oil and gas activities, representing 97-98% of the total amount of oil discharged to the sea during the period 2012 - 2016. Flare drop-out is a minor source of oil discharge and is not covered by OSPAR measures, though it is reported in the UK as a spill should it occur.

It should be noted that dispersed oil in displacement water contributes less than 4% of the total dispersed oil discharged.

The annual average dispersed oil content in produced water has remained relatively stable over the period between 12,8mg/l to 14,6mg/l; well below the current performance standard for dispersed oil of 30 mg/l for produced water discharged into the sea (Fig. 5).

Despite efforts made to reduce the number of installations which exceed the standard, there are still 11 installations that currently do not meet the standard; however, the amount of oil discharged from 8 of these installations is less than 2 tonnes annually in each case. In total the discharge of dispersed oil in excess of the 30mg/l performance standard is 0,3% of the total discharge of dispersed oil in 2016 for the UKCS (Fig. 6).

Spills of oil to sea have varied over the period as might be expected ranging from 26 tonnes to 128 tonnes. There is no apparent trend in the data (Fig. 7).

Chemicals

The use and discharge of chemicals have been regulated by OSPAR and UK national legislation since 2001, with the first national reports provided for 2003. The total quantity of chemicals used offshore decreased during the period 2012 – 2016 (Fig. 9). On average, during the period 2012-2016 less than 2% (by weight) of the total

[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.

amount of chemicals used contains either substances on the OSPAR List of Chemicals for Priority Action (LCPA) or substances which are candidates for substitution.

The total quantity of chemicals discharged into the sea during the period 2012 – 2016 decreased from 68 019 tonnes to 59 306 tonnes and, on average 82% (by weight) of the chemicals discharged are on the OSPAR PLONOR list[2].

OSPAR Recommendation 2005/2 set environmental goals for the reduction of discharges of LCPA substances, and discharges were to be phased out by 2010. This was achieved in the UK by 2012 and continued through until 2016 when there was a 3,4kg discharge of lead-based pipe dope which was mistakenly permitted during drilling operations with a water-based mud (Fig. 10).

OSPAR Recommendation 2006/3 set environmental goals on the phasing out of discharges of chemicals that are, or which contain, substances identified as candidates for substitution[3] by 2017. The quantity of substances identified as candidates for substitution discharged during the period 2012-2016 appears to have levelled off with no obvious trends and with some small variations in quantity discharged between years.

While the reductions in the amounts of LCPA and substitution chemicals discharged since the OSPAR measures came into force are indicative of the success of the relevant OSPAR measures, recent increases are a matter for the UK to consider further.

Atmospheric Emissions

Atmospheric emissions from offshore oil and gas activities are not regulated by OSPAR measures, but are reported annually by operators. Emissions to the atmosphere have generally decreased or remained stable with the exception of NOx which has increased over the period as a result of increased diesel use for power generation due to decreasing fuel gas availability (Figs. 14 & 15).

[2] Pose little or no risk to the environment - PLONOR

[3] Except for those chemicals where, despite considerable efforts, it can be demonstrated that this is not feasible due to technical or safety reasons. Demonstration of those reasons should include a description of the efforts.

Introduction

This report provides an assessment of the discharges, spills and emissions to the environment from offshore oil and gas operations in the UK sector of the OSPAR Maritime Area for the period 2012 – 2016. The purpose of this report is to assess increasing or decreasing trends in the quantities of such discharges, spills and emissions, taking account of the level of oil and gas activity in the UK sector, with the aim of demonstrating the effectiveness of OSPAR measures in the UKCS. Trends have been assessed using expert judgement and not by statistical analyses.

This report does not seek to assess the impact on the environment of these discharges, spill and emissions.

This assessment is based on data submitted by operators on the UKCS to the UK authorities, and reported by the UK in the annual OSPAR report on discharges, spills and emissions from offshore oil and gas installations. Data used in this assessment report are the best available data at the time of preparing the report, and are appended to this report for information at Appendix 2.

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

“OSPAR report on discharges, spills and emissions from the offshore oil and gas activity in 2015” (OSPAR Commission 2016)

“Assessment of the OSPAR report on discharges, spills and emissions from the offshore oil and gas activity 2013-2015” (OSPAR Commission 2016)

“Draft OSPAR report on discharges, spills and emissions from the offshore oil and gas activity in 2016” (EAP Meeting 2017)

The operators have used procedures for sampling and analysis detailed by the Department for Business, Energy & Industrial Strategy (BEIS), and quality assurance procedures described by BEIS and Oil & Gas UK. Accredited or accepted laboratories have been used.

Quality assurance of the data is undertaken by the UK before the data is submitted to the OSPAR Secretariat. Transparency and harmonisation of the reported data are achieved through the use of:

- harmonised sampling and analysis procedures;
- accredited or accepted laboratories;
- harmonised data collection format; and
- review by an Expert Assessment Panel.

Further details on UK QA/QC procedures are discussed in section 7 of this report.

Setting the Scene

Level of Activity

The UK is one of the larger producers of oil and gas in the OSPAR region but the UKCS is a maturing basin with a trend of declining production. Despite this there has been an increase over 2015-16 as new fields come into production, offsetting the cessation of production from older fields. There is still significant investment in the UKCS, including investment in exploration in new areas to the west of Shetland.

Production in the UK had been on a declining trend for many years including at the start of the 2012-2016 period, however with new fields coming on stream, overall production increased by 19% over the 2012-2016 period. While new field production has more than offset any decline from fields which have ceased production, it is expected that without further new development, production will decline again over the next few years, though the level of decline is uncertain. Comparison across the OSPAR region over the 2012-2016 period is varied with decreases in Denmark (28%), Germany (8%) and The Netherlands (22%) and increases in Ireland (501%) and Norway (8%) which has resulted in an overall increase of 8% in production across the OSPAR region.

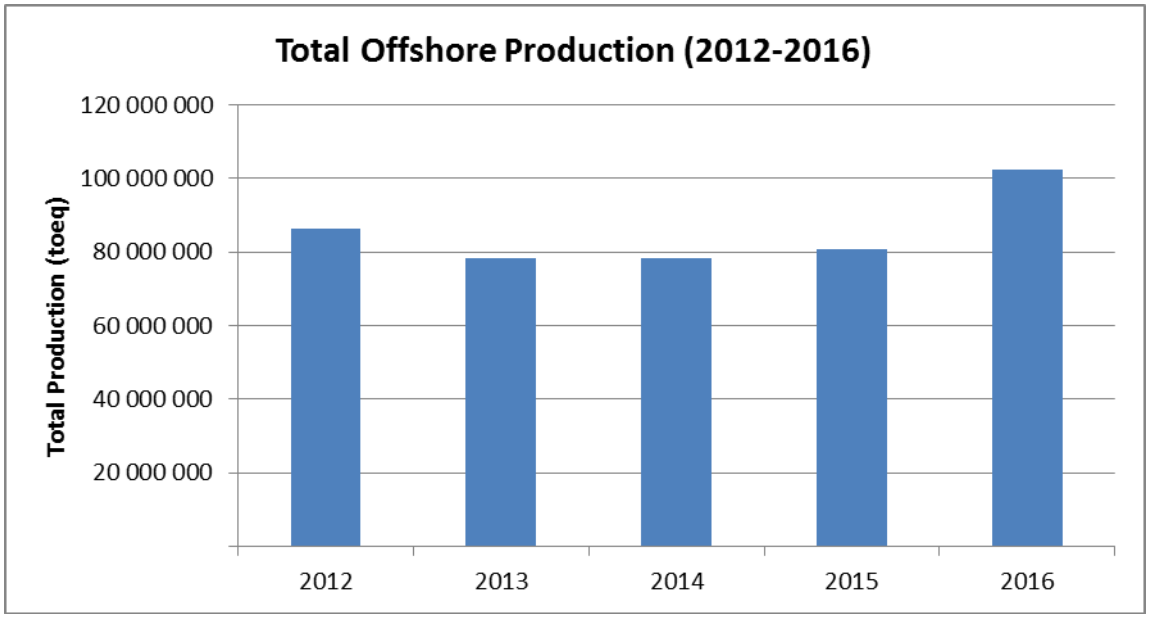


Fig. 1 – Total offshore oil & gas production in the UKCS, 2009-2013

The number of installations with discharges and/or emissions in the UK sector of the OSPAR Maritime Area increased during the period 2012 – 2016 from 489 to 505, with the largest increase being subsea installations (which may discharge hydraulic fluid). During the period 2012 - 2016, 7 surface production installations and 6 subsea installations have also been decommissioned.

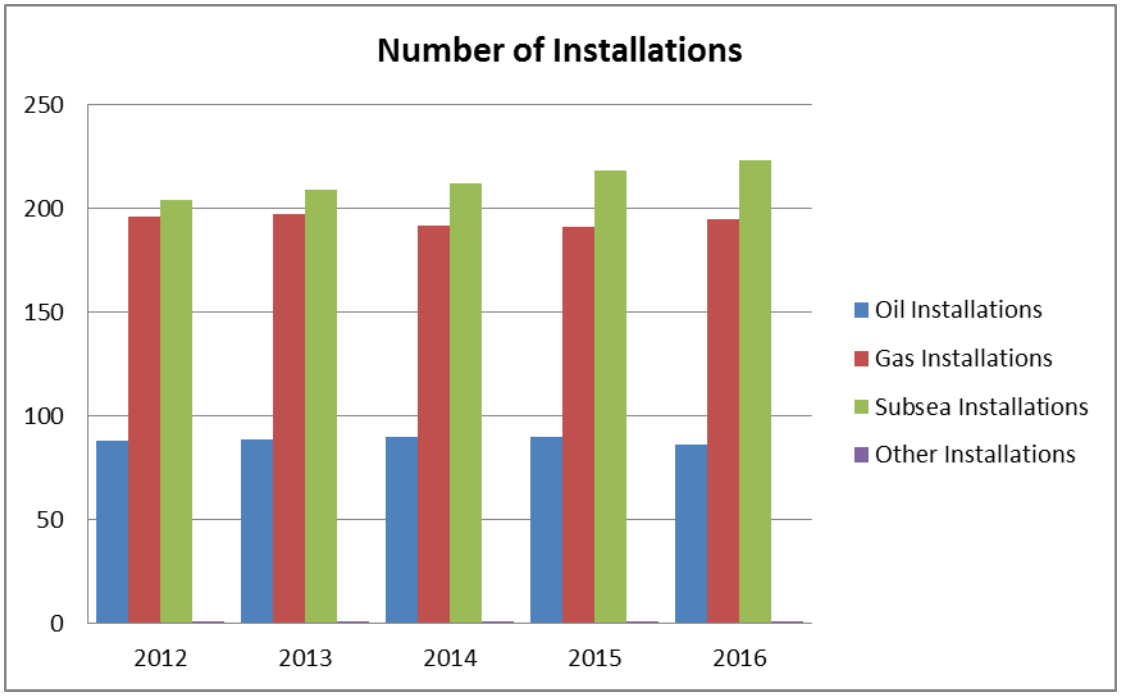


Fig. 2 – Number of Installations on the UKCS, 2012-2016

After a period of decline from 2012-2015 due to low oil price and high operating costs in the UKCS, the number of wells drilled nearly doubled in 2016 from 2015. This reflects action taken by industry to lower operating costs as well as the increase in the oil price. The number of MODU's operating in the UKCS varies year on year, but has been about 20-30 installations over the past five years.

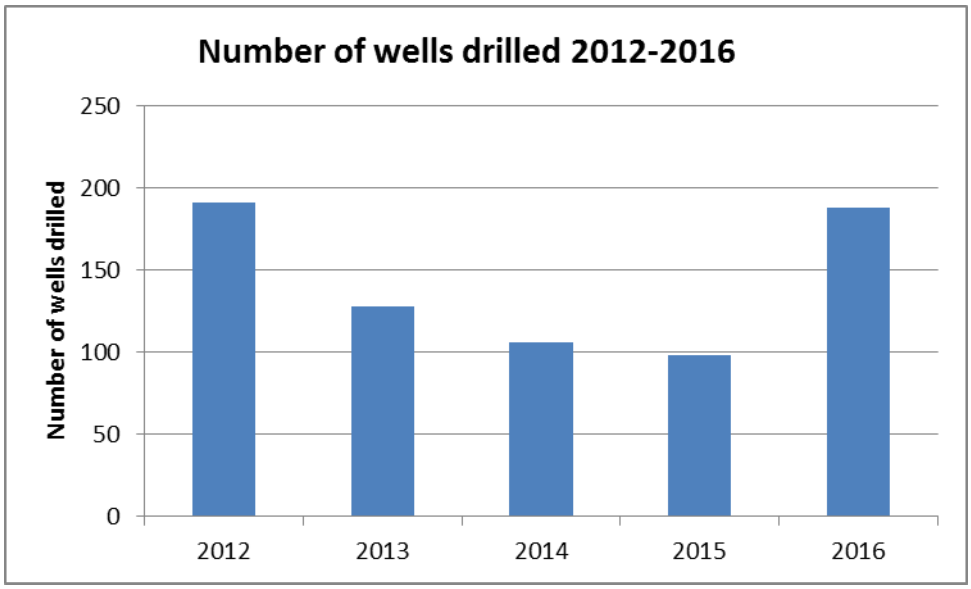


Fig. 3 – Number of wells drilled on UKCS, 2012-2016

Environmental Management

OSPAR Recommendation 2003/5 to Promote the Use and Implementation of Environmental Management Systems by the Offshore Industry was introduced in 2003, with the goal that by the end of 2005 all operators within Contracting Parties jurisdiction should have in place an Environmental Management System that is in accordance with the principles of an internationally recognised standard (ISO14001 or EMAS). The UK implemented this administratively by requiring all licence operators in the UK to have an EMS in place prior to undertaking any offshore oil and gas operations. Operators could either have a certified EMS (ISO14001 or EMAS) or an EMS that was in accordance with the principles of such a standard and was independently verified by a UKAS accredited certification body on a two yearly basis. Operators without a certified or verified EMS would not be granted relevant permits and consents to undertake any offshore oil & gas operations. Since 2006 all operators have had an EMS which meets the UK requirements.

Until 2015 BEIS required that all licence operators in the UKCS undertaking offshore oil & gas operations had an EMS prior to operations commencing. The UK changed its approach to operators following the introduction of the Offshore Safety Directive, which requires that well and installation operators are appointed by licensees. This transferred the environmental responsibilities from the Licensed Operators to the appointed Installation and well operator. These environmental responsibilities include the requirement to have an EMS meeting OSPAR requirements. Of the 57 appointed operators in the UKCS currently undertaking offshore oil & gas operations, 37 are certified to ISO14001 while the remaining 20 have an EMS which has been verified to conform to the principles of ISO14001. In the majority of cases operators with production installations have ISO14001, while the smaller exploration operators have a verified EMS.

Every operator with an EMS must also publish a public statement to cover any offshore oil and gas operations undertaken in the previous year. These public statements are not verified as required by EMAS, but are available from the BEIS website HERE.

Oil Discharges

Discharges of Oil to Sea

Dispersed oil is discharged in accordance with OSPAR Recommendation 2001/1 (as amended) which limits the dispersed oil concentration in produced and displacement water to 30mg/l. The UK implements this Recommendation into UK law through the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (as amended), which replaced the Prevention of Oil Pollution Act 1971. The 2005 regulations require that any discharge of oil to the marine environment is undertaken in accordance with a permit and makes it an offence to discharge oil without a permit or to spill any oil to sea. With regard to produced and displacement water discharges, operators are required to ensure that concentrations of dispersed oil do not exceed 30mg/l as a monthly average. Samples are taken for analysis at least twice a day for installations discharging more than 2 tonnes of dispersed oil per year, or samples are taken at least monthly for installations discharging less than 2 tonnes of dispersed oil per year.

To determine the amount of dispersed oil discharged, operators are required to quantify the amount of produced and displacement water discharged from each installation. The overall measurement uncertainty must be within ±10%.

The Recommendation also requires that Contracting Parties should ensure that plans to construct new offshore installations, or to modify substantially existing offshore installations, should take as a point of

departure the minimisation of discharges and, where appropriate, consider produced water reinjection (PWRI). All new installations have been required to consider this in their proposals to BEIS and where PWRI has not been selected, operators are required to justify the proposals, and in some cases lower limits of between 20-25mg/l have been applied.

Produced & displacement water

The discharge of produced water and displacement water on the UKCS has remained largely steady over the period with an initial decline to 2013 offset by an increase in 2014-2015. On average 157 million cubic metres of produced water and displacement water has been discharged annually over the period 2012-2016. The quantity of injected water decreased from 44,8 million cubic metres in 2012 to 31 million cubic metres in 2014, but then increased to 47,9 million cubic metres by 2016. The proportion of injected water has followed this trend with 22% injected in 2012 and 24% injected by 2016. This reflects newer installations coming on stream with produced water re-injection facilities installed.

The number of installations injecting produced water has also followed a similar trend to the amount of water being re-injected. The number of installations re-injecting produced water decreased from 28 in 2012 to 24 in 2014 and then increased to 27 by 2016. The changes represent 5 installations no longer re-injecting produced water, some due to cessation of production; 2 new installations with PWRI, and 2 existing installations now injecting produced water.

The UK trend in both produced and displacement water discharges, as well as quantities of water injected is largely mirrored in the OSPAR area. Similarly the proportion of water injected across the OSPAR has the same trend as in the UK. Given that the UK is one of the two main contributors, along with Norway, to the overall OSPAR figures this is to be expected.

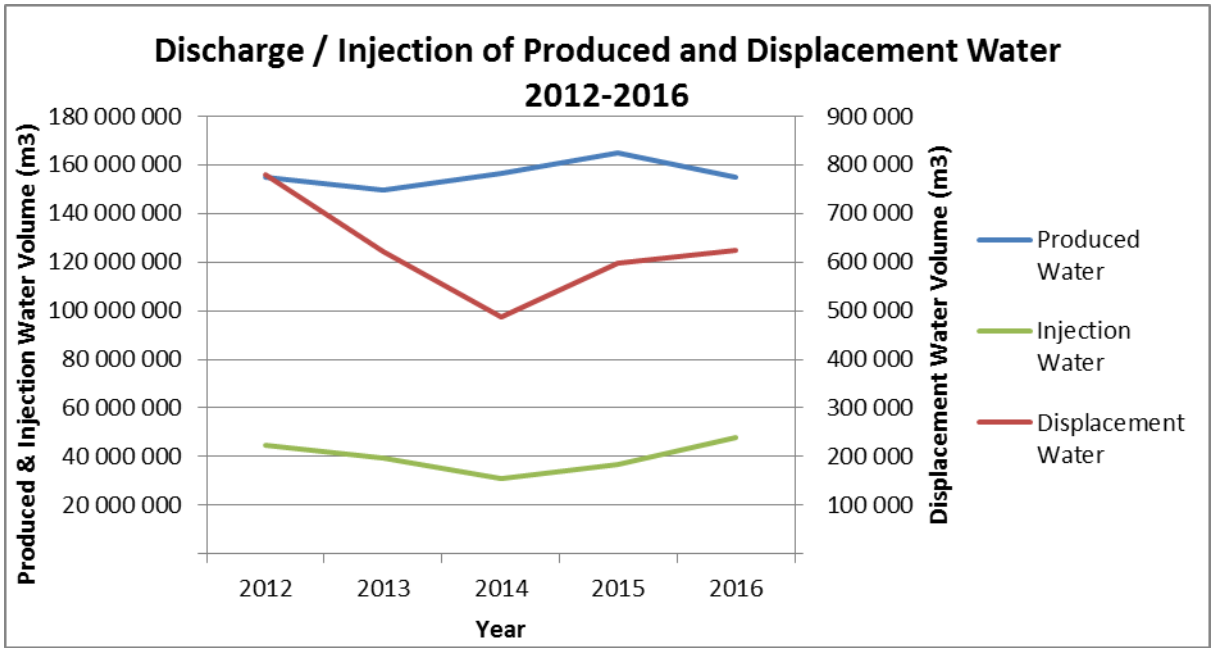


Fig. 4 – Discharge / Injection of produced and displacement water, 2012-2016

Dispersed oil discharged

The total quantity of dispersed oil discharged with produced and displacement water decreased from 2 267 tonnes in 2012 to 2 017 tonnes in 2016, a reduction of 11%. The reduction is due to a decrease in the average concentration as a result of a variety of factors including: some large installations changing correlation factors

or no longer discharging, as well as some newer installations coming on line with better discharge concentrations. The average concentration of dispersed oil in produced water has decreased from 14,6mg/l in 2012 to 13mg/l in 2016.

The reduction in oil discharged in the UK compares favourably with the OSPAR average of a 1% reduction in the amount of dispersed oil discharged to sea, though the UK average concentration dispersed oil in water is higher than the OSPAR average which decreased marginally from 11,5mg/l in 2012 to 11,2mg/l in 2016.

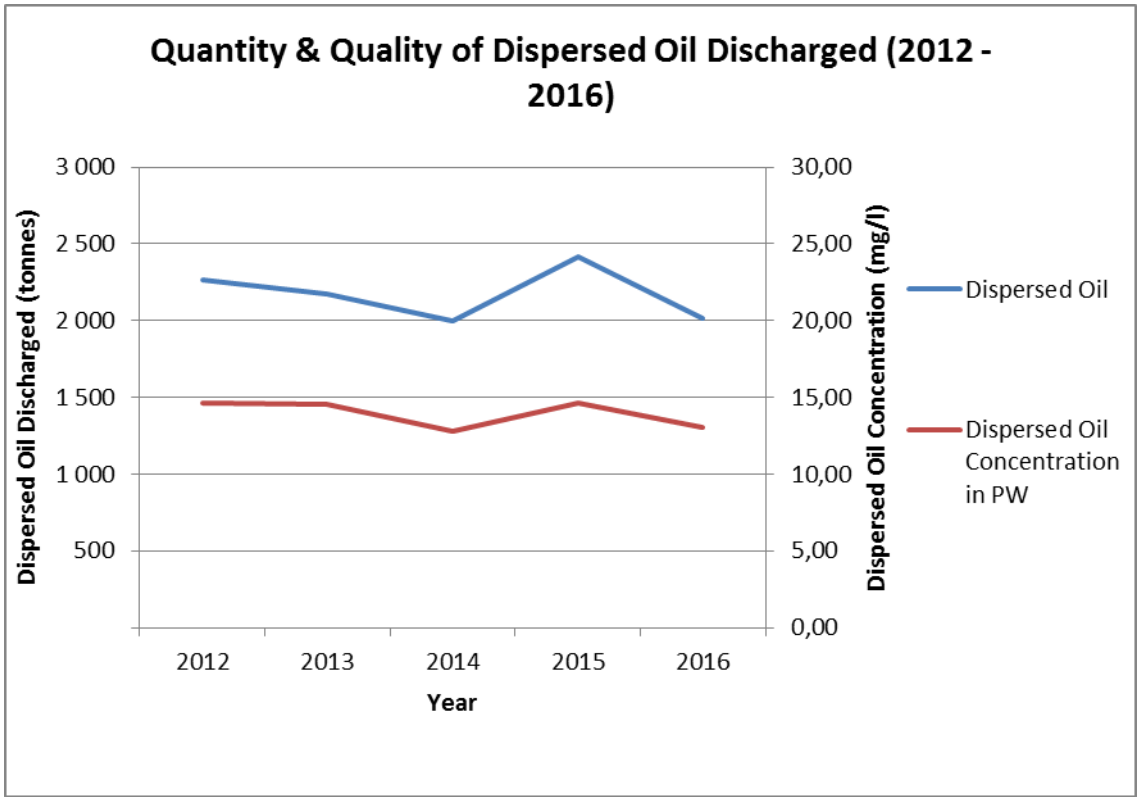


Fig. 5 – Quantity and quality of dispersed oil discharged on UKCS, 2012-2016

Recommendation 2001/1 sets a performance standard for the discharge of dispersed oil in produced water. Since 2007 OSPAR has set the performance standard at 30mg/l. For regulatory purposes in the UK this is calculated as a monthly flow weighted average of all samples, or monthly result where only a single sample is taken. However, for reporting to OSPAR the UK calculates an annual average. While the majority of installations in the UK sector meet the performance standard, a number of installations (11-14) fail to meet this performance standard on an annual basis.

The quantity of dispersed oil discharged by installations that failed to meet the performance standard has reduced during the period 2012 – 2016, with the exception of 2013, decreased from 44,1 tonnes dispersed oil in 2012 to 5,7 tonnes dispersed oil in 2016. The installations which fail to meet the performance standard are usually either installations which mostly re-inject produced water but have process trips and discharge at >30mg/l or gas / condensate installations with low produced water volumes, process constraints and/or oil chemistries hindering separation.

It should be noted that, when PWRI stops working, some installations with a high PWRI uptime may discharge produced water overboard in excess of the performance standard. This is generally for very short periods of time, but if the average of the analyses fails to meet the performance standard for the year they are still reported to OSPAR.

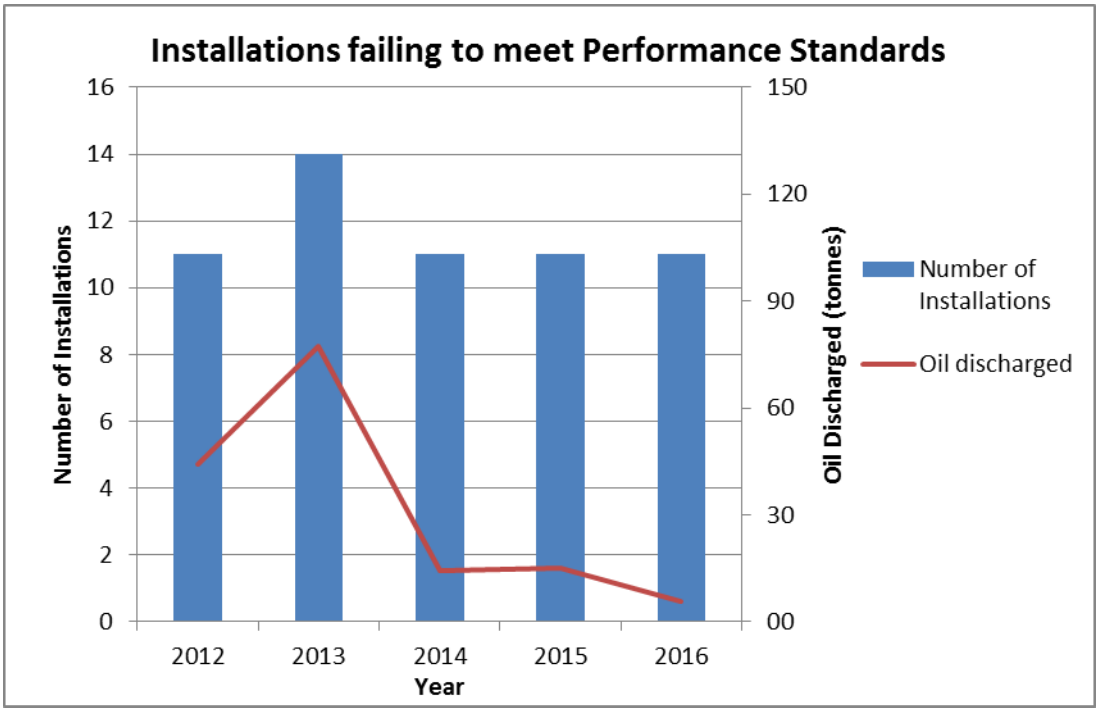


Fig. 6 – Installations failing to meet the 2001/1 Performance Standard, 2012 - 2016

The UK also reports the dissolved oil content (as represented by BTEX components) in produced water and displacement water discharges. OSPAR does not have measures in place for these discharges as the components rapidly biodegrade in seawater once discharged. The discharge of dissolved oil[4] (BTEX) during the period 2012 - 2016 has ranged between 2140 to 2508 tonnes per year, though there was a peak in 2013 of 4010 tonnes due to an analytical error which was not picked up at the time.

Risk-based Approach (RBA)

In 2012, OSPAR Recommendation 2012/5 for a risk-based approach to the management of produced water discharges from offshore installations was adopted. The UK drafted guidance for industry and adopted a phased implementation plan to allow the additional assessments to be evenly spread over the 2014 - 2018 period for the 105 installations affected. The UK has adopted a substance level and whole effluent toxicity approach for the RBA assessments, which commenced in 2014, with approximately 20 installations undertaking an assessment each year through to 2018. The UK has requested that operators undertake the full assessment process, including dispersion modelling, so as to be able to determine a baseline for all installations with a produced water discharge. Through to the end of 2016, 48 installations had been assessed with 35 installations still awaiting the outcome of the assessment. The UK regulator will be undertaking modelling at the substance level for selected assessment where the principal contributors to the Environmental Impact Factor have been identified as added chemicals.

Spills of Oil to Sea

The number of oil spills to sea during the period 2012 - 2016 has varied year on year from as low as 247 spills in 2012 up to 410 spills in 2014. The quantity spilled has also varied from as low as 25,5 tonnes in 2016 up to 522 tonnes in 2012. Less than 3% of the total number of spills is greater than 1 tonne in each year, but they have contributed from 46% to 98% of the oil spilled from offshore oil and gas installations in the UKCS. The

[4] "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.

number of spills and quantity spilled varies greatly across the OSPAR region and comparison of performance is not possible.

It should be noted that in 2012, 522 tonnes of oil was spilled, and this represented 18,7% (by weight) of the total dispersed oil discharged or spilled to the UKCS, however in other years oil spills contribute 1,3-5,6% of the total dispersed oil discharged or spilled to the UKCS.

The large spill quantity in 2012 is mainly attributable to the Elgin incident where 405 tonnes of condensate was spilled.

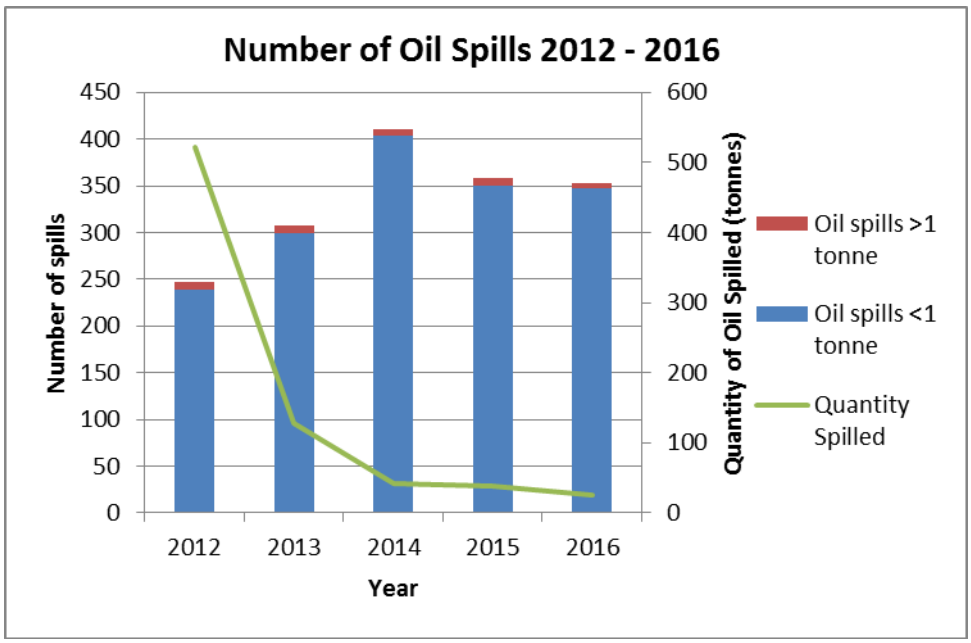


Fig. 7 – Number of oil spills and quantity of oil spilled in UKCS, 2012-2016

It should be noted that some oil spill data has not been included in the above data or this report, as the incidents are still under investigation by the UK Regulator.

Discharges of Organic Phase Fluids

OSPAR Decision 2000/3 aims to prevent and eliminate pollution resulting from the use and discharge of OPF and OPF-contaminated cuttings[5] and prohibits the discharge of cuttings contaminated with OBF[6] at a concentration greater than 1% by weight on cuttings. The UK implements this Decision under The Offshore Chemical Regulations 2002 (as amended), which controls the use and discharge of all offshore chemicals. The regulations prohibit the discharge of OPF and OPF contaminated cuttings, except in accordance with the terms and conditions of a permit issued under the regulations. The development of thermal desorption technologies (Roto-mill, hammer mill, etc), which readily achieves less than the 1% concentration limit, has resulted in a number of wells being drilled using OBF with treated cuttings discharged to sea. Over the period this has increased from 8 such wells in 2012 to 17 in 2016 (Fig. 8).

[5] OPF = Organic-phase Drilling Fluids

[6] OBF = Oil-based fluids

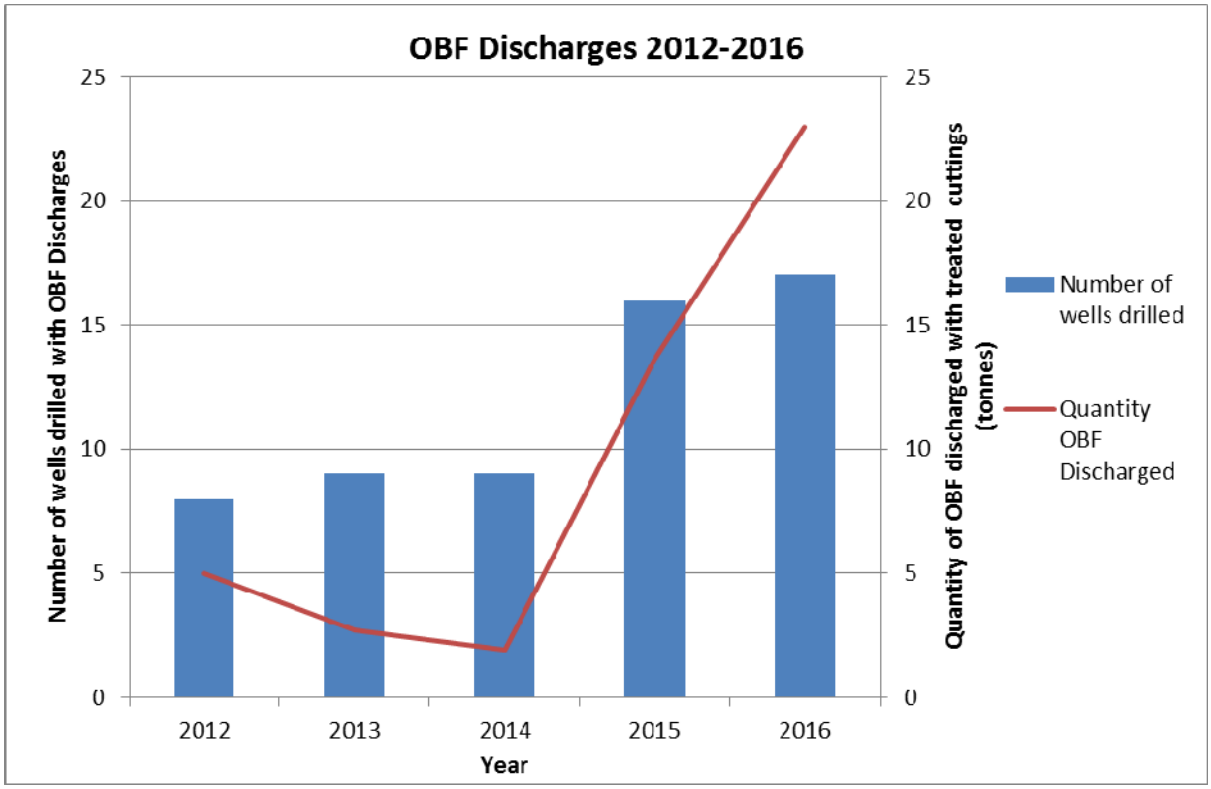


Fig. 8 – Discharges of OBF on UKCS 2012-2016

Discharge concentrations must be reported and are usually less than 0,1% which is significantly lower than the limit set by OSPAR.

Chemicals

Since 2001 the use and discharge of offshore chemicals have been covered by a number of OSPAR measures as listed in the Appendix 1, and these have been implemented in the UK through the Offshore Chemical Regulations 2002 (as amended). The regulations require that all use and discharge of offshore chemicals requires a permit, with the permit application setting out the circumstances of use and discharge of chemicals and the quantities of chemicals to be used and discharged.

The regulations and associated guidance requires that chemicals are assessed for their impact to the environment using the Offshore Chemical Notification Scheme (OCNS) which is managed on behalf of the UK regulator by the Centre for Environment, Fisheries & Aquaculture Science (CEFAS), which also undertakes a similar function for the Netherlands. The OCNS uses the OSPAR Harmonised Mandatory Control Scheme (HMCS) to rank chemical products according to Hazard Quotient (HQ), calculated using the Chemical Hazard and Risk Management (CHARM) model.

Details of the categories within HMCS are detailed in OSPAR Decision 2000/2 on a Harmonised Mandatory Control System for the Use and Reduction of the Discharge of Offshore Chemicals (as amended).

In this report the term *substitution chemical* refers to chemicals which are or contain substances that are candidates for substitution, according to OSPAR Recommendation 2010/4. This includes chemicals or substances 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} ≥ 3, or
  - LC_{50}/EC_{50} less than 10mg/L.

Chemicals that are considered to 'Pose Little or No Risk' to the environment are referred to as PLONOR chemicals. Chemicals that are considered to be PLONOR are detailed on the OSPAR PLONOR list.

Chemicals that are neither PLONOR nor candidates for substitution include those that are:

- inorganic with LC50 or EC50 greater than 1 mg/l,
- Ranking chemicals, which includes substances ranked according to OSPAR Recommendation 2000/4 and don't fall into another category.

For the purposes of this report these latter two chemical groups are combined and referred to as Ranking.

The goal of OSPAR Recommendation 2006/3 is for discharges of substitution chemicals to be phased out by 2017, although an exception can be made for chemicals with no identified alternative.

The goal of OSPAR Recommendation 2005/2 was that the discharge of chemicals on the OSPAR List of Chemicals for Priority Action (LCPA) would be phased out by 1 January 2010. The UK had phased out these discharges as of 2015 although small amounts of lead based pipe dope are still used in the UK for certain drilling operations. Unfortunately in 2016 a small quantity (3,39kg) was mistakenly permitted for discharge during a drilling operation.

Chemical Use & Discharge

Total use of chemicals between 2012 and 2015 had been on the increase but there was a sharp decrease in 2016. Total discharge of chemicals has shown a decline since a peak in 2013. This may be associated with an increase in cessation of production operations

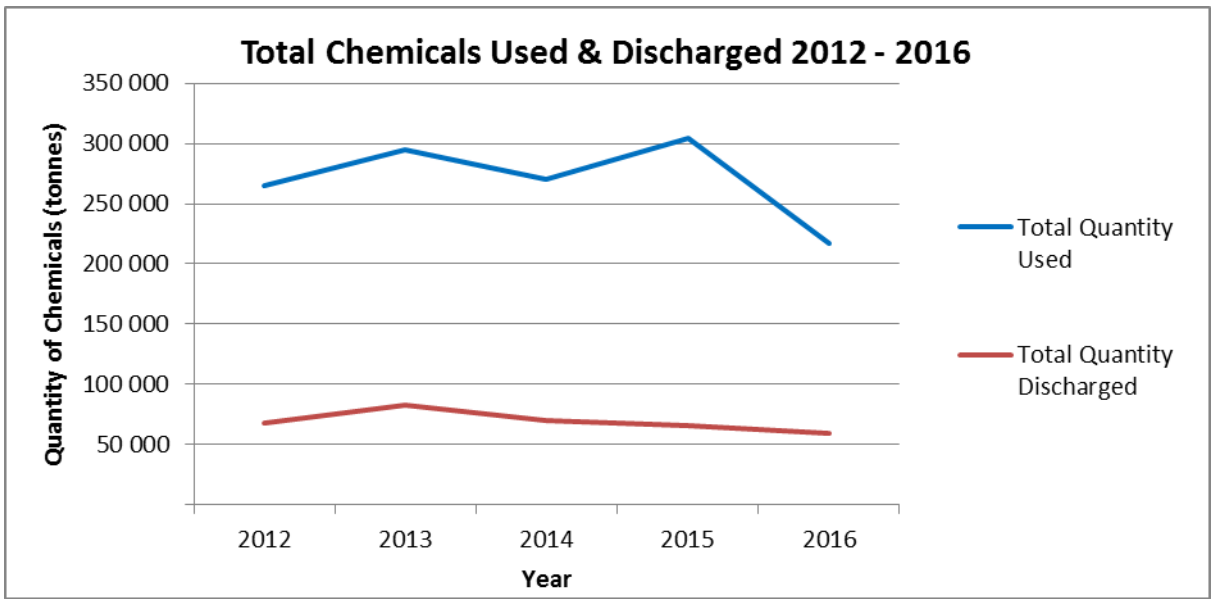


Fig. 9 – Total chemical use and discharge on UKCS 2012-2016

6.1.1 Chemicals used

The total quantity of chemicals used offshore has varied year on year from a peak in 2015 of 303 998 tonnes to a low of 217 012 tonnes in 2016. Overall there was an 18% decrease by 2016 from total use in 2012 (Fig. 9).

On average over the 2012-2016 period just under 70% (by weight) of the chemicals used were on the PLONOR list and another 28,5% (by weight) contained other substances which are not candidates for substitution. Approximately 2% (by weight) of the chemicals used contained substances listed on the List of Chemicals for Priority Action (LCPA) or are candidates for substitution. Comparable OSPAR figures in 2016 are that 71% (by weight) of chemicals used were PLONOR and 28% (by weight) of chemicals used were other substances which are not candidates for substitution.

Chemicals discharged

The total quantity of chemicals discharged offshore has varied year on year from a peak in 2013 of 82 813 tonnes to a low of 59 306 tonnes in 2016. Overall there was a 13% decrease by 2016 from total use in 2012(Fig. 9). On average over the 2012-2016 period just over 82% (by weight) of the chemicals used were on the PLONOR list and another 16% (by weight) contained other substances which are not candidates for substitution. Only 1,7% (by weight) of the chemicals discharged contained substances listed on the List of Chemicals for Priority Action (LCPA) or are candidates for substitution. Comparable OSPAR average figures for 2016 are that 83% (by weight) of chemicals discharged were PLONOR and 16% (by weight) were other substances which are not candidates for substitution. Less than 1% (by weight) of the chemicals discharged contained substances listed on the List of Chemicals for Priority Action (LCPA) or are candidates for substitution.

LCPA chemicals and candidates for substitution

The amount of LCPA substances used continued to decrease during the period 2012 - 2016, from 440kg in 2012 to 223kg in 2016. There has been zero discharge of LCPA substances throughout the 2012-2015 period, while there was a 3,4kg discharge of a LCPA substance (lead based pipe-dope) associated with a discharge of water based drilling fluid, which was permitted by mistake (Fig. 10). Across the OSPAR region while some LCPA chemicals are still used, their discharge, other than for the UK in 2016, has entirely ceased.

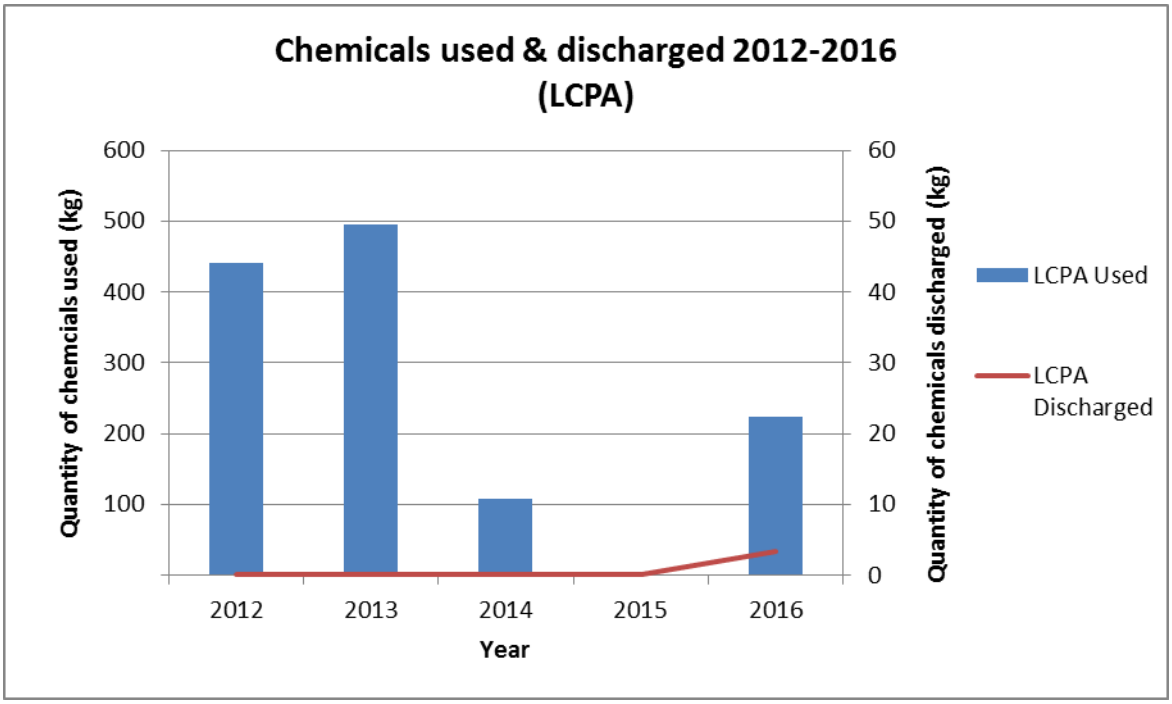


Fig. 10 – LCPA chemicals used and discharged on UKCS 2012-2016

The quantity of substances identified as candidates for substitution discharged during the period 2012-2016 appears to have levelled off with no obvious trends and with some small variations in quantity discharged between years (Fig. 11). There is no obvious explanation for the variations. There is no direct correlation to the wider OSPAR region as a consequence of recent changes in categorisation. In 2015 Norway, and then in 2016

Denmark, changed the categorisation of sodium hypochlorite from a non-substitution chemical to a substitution chemical. As a result there has been a substantial increase in the reported use and discharge of LC50 or EC50 < 1mg/l chemicals. As a result across the OSPAR region there has been a 17% decrease in use of substitution chemicals but a 44% increase in the discharge of such chemicals from 992 tonnes in 2012 to 1429 tonnes in 2016.

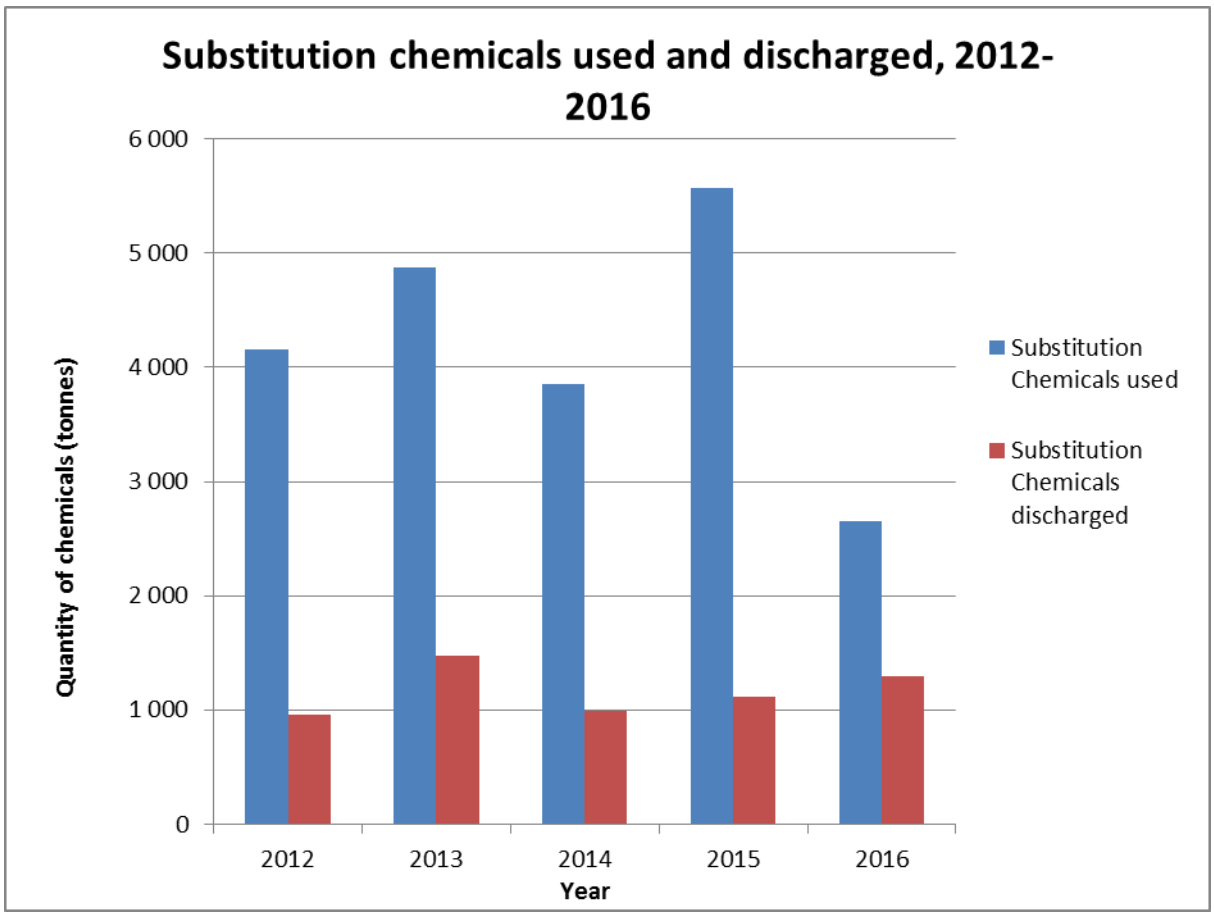


Fig. 11 – Use and discharge of chemicals which are candidates for substitution 2012-2016

While there are measures (Recommendations and Decisions) in place which aim to prevent or minimise the discharge of certain chemicals (LCPA and candidates for substitution) to the marine environment, there are no specific measures in place to achieve a reduction in the use and discharge of other chemicals, other than the general OSPAR Offshore Industry Strategy[7] to prevent and eliminate pollution and take the necessary measures to protect the OSPAR maritime area against the adverse effects of offshore activities. Chemicals with no OSPAR measures are those that are categorised as PLONOR or Ranking substances.

In the UK the use and discharge of such substances has decreased by 18% and 14% respectively between 2012 and 2016 (Fig. 12). Across the OSPAR region the use and discharge of such substances has decreased by 6% and 16% respectively over the same period. The decrease over the OSPAR area would have been larger, but for the change in categorisation of sodium hypochlorite as mentioned above.

[7] The OSPAR Offshore Oil and Gas Industry Strategy is at: https://www.ospar.org/site/assets/files/1469/offshore_strategy.pdf

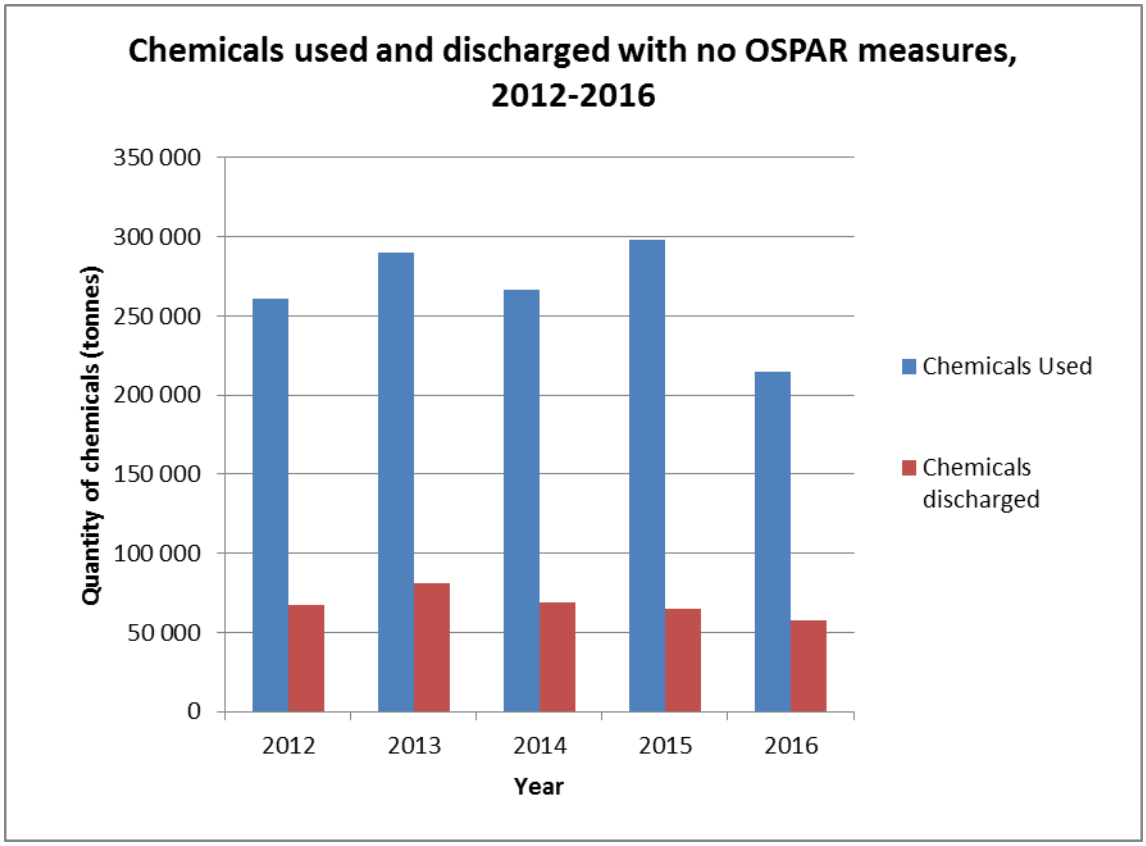


Fig. 12 – Use and discharge of chemicals with no OSPAR measures, 2012-2016

Chemical Spills

The number of chemical spills to sea during the period 2012 - 2016 ranged from 202 to 273. The total quantity spilled also ranged from 327 tonnes up to 1224 tonnes (Fig. 13). Less than 22% of the total number of spills were greater than 1 tonne, but they contributed up to 97% of all the chemicals spilled from offshore oil and gas installations in the UKCS. Given the random nature of spills no conclusions can be drawn from the frequency or quantity of spills, either in the UK or across the OSPAR region.

The vast majority (greater than 98%) of chemicals spilled were either on the PLONOR list or were Ranking substances. During the period 2012 – 2016 there were no spills of LCPA chemicals.

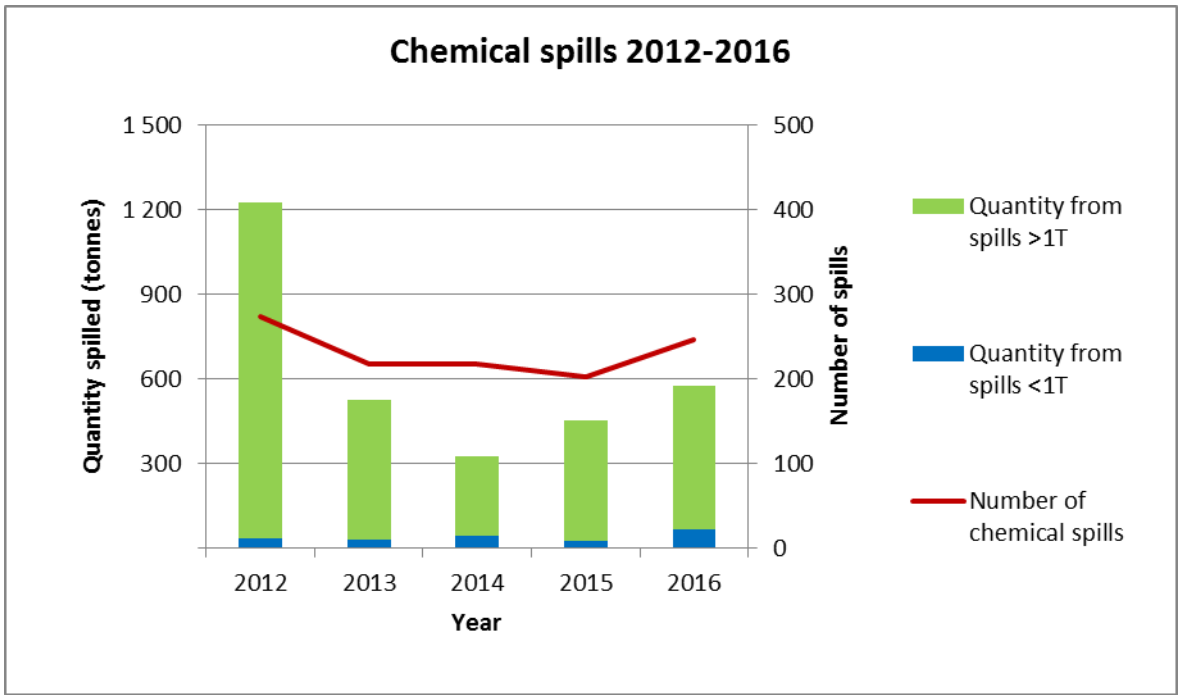


Fig. 13 – Chemical spills on UKCS 2012-2016

It should be noted that some chemical spill data has not been included in the above data as the incidents are still under investigation by the UK regulator. Some spill data previously excluded as it was under investigation has now been included. This includes 388 tonnes in 2012, 18 tonnes in 2013 and 34 tonnes in 2014. The bulk of the quantity added in 2012 was from the Elgin incident (365 tonnes).

Emissions to Air

Atmospheric emissions are not covered by OSPAR measures or harmonised measuring methodologies, but atmospheric pollutants are reported to OSPAR and, for larger installations, are regulated under relevant EU Directives that have been transposed into UK legislation. Consistency and quality of the data reported have undoubtedly improved over the past few years, particularly with regard to CO_2 emissions that are independently verified as required under of the EU ETS Directive.

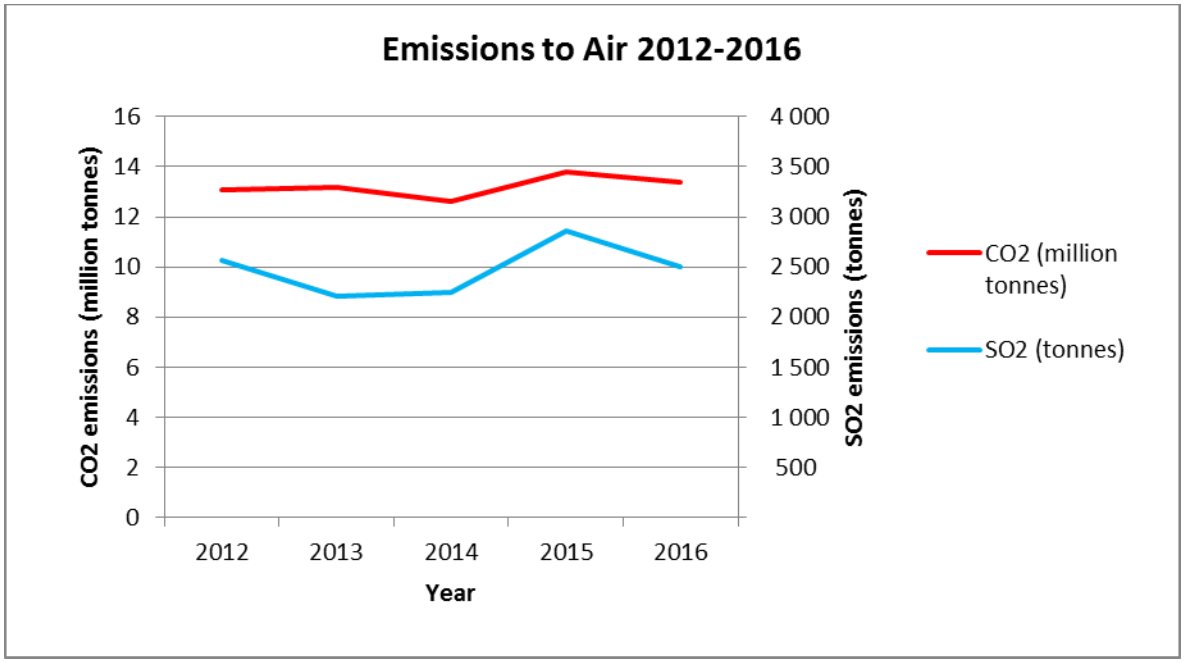


Fig. 14 – Emissions to air on UKCS (CO_2 & SO_2), 2012-2016

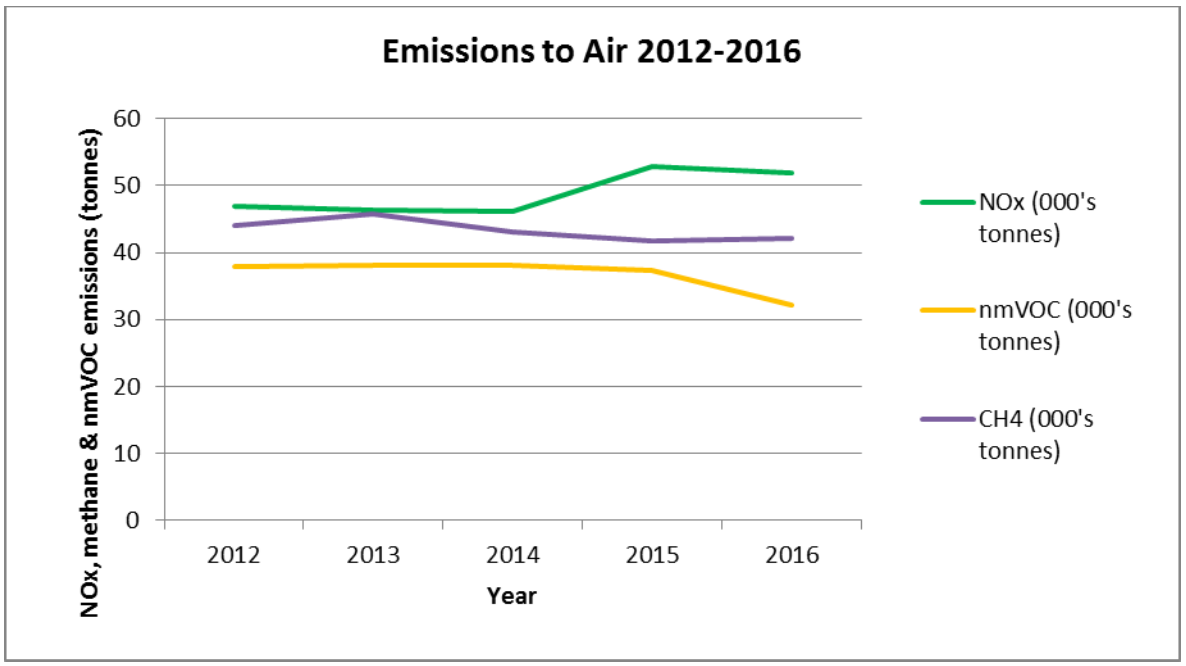


Fig. 15 – Emissions to air on UKCS (NOx, nmVOC, CH_4), 2012-2016

The majority of atmospheric emissions were generally stable, or showed a downward trend between 2012 and 2016, with the notable exception of NOx emissions. nmVOC's decreased by 15%, methane by 4,5%, and SO_2 by 2%, but CO_2 and NOx emissions increased by 2% and 10% respectively (Figs 14 & 15).

The increase in NOx is likely due to an increase in use of diesel for power generation, while the reduction in nmVOC's may be due to the reduction in the number of FPSO's in operation and a decrease in venting.

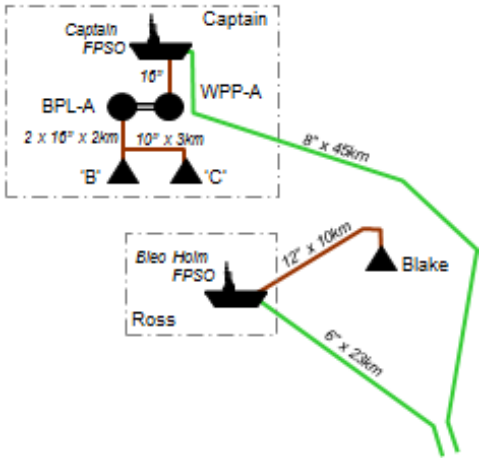
By comparison, across the OSPAR region for the same period reductions have been 11% for CO_2 and 12% for SO_2, though there was a notable reduction in SO_2 reported by the Netherlands possibly due to previous inclusion of onshore emissions. There was no overall change in the amount of NOx emissions, CO_2 emissions increased by 2% and nmVOC emissions increased by 5% over the same period.

Summary of Counting & QA Procedures in UK relating to OSPAR Data

Counting of Installations

There are some differences in the manner in which Contracting Parties count installations. The UK counts installations as follows:

All installations are counted, irrespective of whether there is a local discharge, on the basis that surface installations will always have emissions to air and drainage discharges to sea, and there could also be unscheduled discharges such as oil or chemical spills from all surface and subsea installations. Installations which are connected by walkways or bridges are also each counted separately. For subsea installations, rather than reporting one installation per well or cluster of well heads, the UK considers that all the subsea wells or well clusters serving a single field should be reported as one installation. For example if a field has been developed solely as a subsea facility it will be reported as a single subsea installation, even if it has more than one well or more than one cluster of wells. It is recognised that in some cases a field can also consist of a surface facility and a number of subsea wells or well clusters that are remote from the surface facility. In such cases the UK reports the surface and subsea facilities separately. The UK uses nodal diagrams to summarise information relating to subsea fields. For example, the Captain Field consists of a Floating Production facility, two bridge-linked surface installations and two subsea drill centres (see diagram below). The UK reports this as three surface oil installations and one subsea installations as the two groups of wellheads are associated with the main field), rather than two surface oil installations and two subsea installations (i.e. one for each cluster of well heads). In a similar manner Ross would be counted as one surface oil installation and one subsea installations (BleoHolm FPSO and Blake).



Reporting of Dispersed Oil

In the UK operators are required to both quantify the amount of produced and displacement water discharged and determine the concentration of dispersed oil in the discharge.

Quantification of the discharge is required to meet a +/-10% uncertainty measurement which must be verified through a measurement uncertainty calculation. Measurement is typically undertaken using meters (ultrasonic, magflow or orifice meters) which must be calibrated on a regular basis to ensure the accuracy of the measurement. In some cases where it is not possible to install a meter, well test data or other mass balance approaches are used. However, these should also seek to achieve the +/-10% measurement

uncertainty, for example by suitably maintaining other measurement devices and undertaking frequent well flow testing.

The concentration of dispersed oil is determined by sampling the discharge stream on a routine basis and analysing the samples in accordance with UK Guidance. Operators are required to sample discharge streams a minimum of twice per day for discharges of greater than 2 tonnes dispersed oil per year or at least monthly for installations with discharges of less than 2 tonnes dispersed oil per year. The sampling frequency for discharges of greater than 2 tonnes dispersed oil per year is greater than the minimum required under the OSPAR Recommendation 2001/1 and some installations sample up to 4 times daily. Where operations result in process upsets sampling is undertaken more frequently.

Although spot sampling provides an indication of discharge quality, it is recognised that there can be significant variation in water quality over short periods of time and that there is a great deal of uncertainty associated with the sampling regime. Operators of installations with large discharges, and operators of new installations, are therefore encouraged to use online analysers for process monitoring to provide a real time indication of produced water quality so that any deterioration in quality can be responded to more quickly.

While operators are required to report analysis results in accordance with the OSPAR Reference method the majority of UK installations continue to undertake onsite analysis using infra-red techniques and the results are then converted to an OSPAR Reference Method result using correlation graphs, which are updated at least every 6 months.

Dispersed oil discharges are reported every month using the UK Environmental and Emissions Monitoring System (EEMS) and reports are regularly checked, including at the end of each year, to identify any anomalies. The audit trail of results from offshore analysis to reporting via EEMS is also checked during offshore inspections.

Reporting of Chemical Use & Discharge

Operators in the UK are required to record the use and discharge of all offshore chemicals included in their chemical permits, in accordance with the terms and conditions of the permit. Operators are required to report the use and discharge to the UK regulator upon completion of specific activities or on a quarterly basis. Quantification methods for chemical use and discharge vary greatly from operator to operator. Some report the quantities shipped from suppliers which may only provide a rough estimate over the quarter but will average out over the year or longer periods, while others record daily consumption from stock tanks on board the installation which provides a more accurate and consistent measurement. There is no measurement uncertainty requirement, but it is likely that this would be within +/-10% where measurement is based on stock tank levels onboard the installation.

Chemical use and discharge is reported via EEMS, and the UK regulator can run reports to compare permitted use and discharge against reported use and discharge to check for any significant variations, breaches or obvious transcription errors. The operators' chemical management systems and methods of reporting are also reviewed during offshore inspections.

Reporting of Atmospheric Emissions

Operators are required to report atmospheric emissions via EEMS on an annual basis. For larger installations, the determination of CO_2 emissions is undertaken in accordance with the installation's monitoring and reporting plan submitted under The Greenhouse Gas Emissions Trading Scheme Regulations 2012, which sets requirements for measurement uncertainty of +/-2.5 for combustion equipment fuel sources and +/-5% for flare fuel sources. Measurement varies depending upon the type of emission, for example fuel gas used for combustion equipment and flare will usually be metered, although installations that are not included in the EU ETS may use a mass balance approach based on the amount of gas produced vs the amount exported, flared

and consumed. For diesel consumption this is typically quantified by the measured reduction in tank levels on a daily basis. Atmospheric emissions are determined using standard emission factors based upon the fuel used, with samples taken to determine the composition of fuel gas on a quarterly basis.

Emissions reported to EEMS are reviewed to identify any unusual results and reports can also be run to cover a number of years to review trends. Transcription errors are often identified at this stage.

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[8];

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.

[8] 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.

Appendix 2: Data Annexes

Table 1a: Number of installations in the UK maritime area with discharges to the sea, or emissions to the air 2012-2016

2012	2013	2014	2015	2016
489	496	495	500	505

Table 1b: Number of installations by type of installation in the UK maritime area with discharges to the sea, or emissions to the air, 2012-2016

	2012	2013	2014	2015	2016
Oil	88	89	90	90	86
Gas	196	197	192	191	195
Subsea	204	209	212	218	223
Other	1	1	1	1	1
Total	489	496	495	500	505

Wells	191	128	106	98	188

Table 2: Oily aqueous discharges to the maritime area*

Table 2a: Oil discharged in displacement and produced water (in tonnes), 2012-2016

2012	2013	2014	2015	2016
2 267	2 176	1 997	2 412	2 017

Table 2b: Dissolved oil discharged in displacement and produced water (in tonnes), 2012-2016

2012	2013	2014	2015	2016
Dissolved	Dissolved	BTEX	BTEX	BTEX
2 178	4 010*	2 432	2 508	2 140

* Suspected sampling and analytical error resulting in significant increase in result.

Table 2c: Total volume of produced water and displacement water discharged, and produced water injected (in m^3/year), 2012-2016

	2012	2013	2014	2015	2016
PW*	155 054 739	149 342 962	156 247 100	164 689 547	154 840 018
DPW**	778 417	621 196	487 593	596 642	623 039
IPW***	44 814 833	39 143 588	31 090 615	36 903 626	47 860 183
Total	**200 647 989**	**189 107 746**	**187 825 308**	**202 189 815**	**203 323 240**

* 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 exceeding the 30 mg oil/l performance standard, valid from 2007 onwards, and quantity of oil discharged by these installations (in tonnes), in excess of the 30 mg/performance standard

	2012	2013	2014	2015	2016
Number of installations exceeding 30 mg/l	11	14	11	11	11
Quantity of dispersed oil discharged	44,1	77,4	14,5	15,2	5,7

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), 2012-2016

2012	2013	2014	2015	2016
Total OPF	Total OPF	Total OPF	Total OPF	Total OPF
5	2,7	1,9	13,6	23,0

Table 4b: Number of wells drilled with OPF, with discharge of contaminated cuttings to the maritime area, 2012-2016

2012		2013		2014		2015		2016	
OBF	non-OBF OPF	OBF	non-OBF OPF	OBF	Other OPF	OBF	Other OPF	OBF	Other OPF
8	0	9	0	9	0	16	0	17	0

Table 5: Spillage of oil and chemicals

Table 5a: Number of oil spills, 2012-2016 - Spills less than 1 tonne (≤ 1 T) and spills above 1 tonne (> 1 T)

2012		2013		2014		2015		2016	
≤ 1 T	> 1 T	≤ 1 T	> 1 T	≤ 1 T	> 1 T	≤ 1 T	> 1 T	≤ 1 T	> 1 T
239	8	299	9	404	6	350	8	348	5

Table 5b: Total quantity of oil spilled, in tonnes, 2012-2016

2012		2013		2014		2015		2016	
≤ 1 T	> 1 T	≤ 1 T	> 1 T	≤ 1 T	> 1 T	≤ 1 T	> 1 T	≤ 1 T	> 1 T
11,4	510	17,3	111	22,5	19	14,1	25	11,6	14

Table 5c: Number of spills of chemicals and amount of chemical spills in tonnes/year, 2012-2016

	2012	2013	2014	2015	2016
Number of spills of chemicals	273	217	217	202	246
Tonnage of spilled chemicals	1 224	523	327	450	575

Table 6: Emissions to air, 2012-2016

CO_2 (in millions of tonnes)

2012	2013	2014	2015	2016
13,08	13,17	12,59	13,77	13,40

NO_x (in thousand of tonnes)

2012	2013	2014	2015	2016
47,01	46,40	46,07	52,81	51,86

nmVOCs (in thousands of tonnes)

2012	2013	2014	2015	2016
37,96	38,08	38,10	37,31	32,12

CH_4 (in thousand of tonnes)

2012	2013	2014	2015	2016
44,12	45,69	43,08	41,70	42,15

SO_2 (in tonnes)

2012	2013	2014	2015	2016
2 561	2 208	2 241	2 864	2 506

Table 7: The use and discharge of offshore chemicals, 2012-2016

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

Pre-screening category	2012	2013	2014	2015	2016
List of Chemicals for Priority Action	440	496	108	0	223
Inorganic LC50 or EC50 < 1 mg/l*	1 848	254	546	294	291
Biodegradation < 20%*	1 784 069	2 042 658	1 644 336	3 504 469	1 170 337
Substance meets two of three criteria*	2 370 810	2 826 647	2 204 106	2 064 376	1 481 436
PLONOR	189 057 474	207 602 076	185 467 972	211 799 667	150 546 941
Inorganic, LC50 or EC50 > 1 mg/l	2 313 743	3 146 799	2 116 846	2 494 697	1 342 891
Ranking Substances	69 690 462	79 106 416	78 631 851	84 134 667	62 469 981
Total	265 218 846	294 725 346	270 065 764	303 998 171	217 012 100

* Chemicals which are candidates for substitution

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

Pre-screening category	2012	2013	2014	2015	2016
List of Chemicals for Priority Action	0	0	0	0	3,4
Inorganic LC50 or EC50 < 1 mg/l*	1 643	90	79	179	119,7
Biodegradation < 20%*	305 385	576 846	345 846	294 371	472 359
Substance meets two of three criteria*	648 520	896 187	646 476	818 122	819 485
PLONOR	56 070 241	70 139 373	58 222 340	52 492 691	47 614 750
Inorganic, LC50 or EC50 > 1 mg/l	384 226	858 274	463 057	475 932	365 463
Ranking Substances	10 609 116	10 341 731	10 074 380	11 571 081	10 033 343
Total	**68 019 131**	**82 812 500**	**69 752 179**	**65 652 376**	**59 305 522**

* Chemicals which are candidates for substitution

Table 7c: Chemicals spilled in kg per year

Pre-screening category	2012	2013	2014	2015	2016
List of Chemicals for Priority Action	0	0	0	0	0
Inorganic LC_{50} or EC_{50} < 1 mg/l*	2,6	0	0	0	0
Biodegradation < 20%*	7 858	90	395	606	2 217
Substance meets two of three criteria*	14 267	60	793	480	404
PLONOR	489 815	340 020	129 602	231 963	304419
Inorganic, LC_{50} or EC_{50} > 1 mg/l	614	72	161	242	1 941
Ranking Substances	51 632	55 368	46 456	25 115	145 370
Total	**564 189**	**395 610**	**177 407**	**258 406**	**454 351**

* Chemicals which are candidates for substitution

Table 8: UK total production in oil equivalents, (toeq)

2012	2013	2014	2015	2016
86 480 357	78 304 262	78 229 908	80 859 966	102 538 306

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