OIL&GASUK

ENVIRONMENT REPORT 2016

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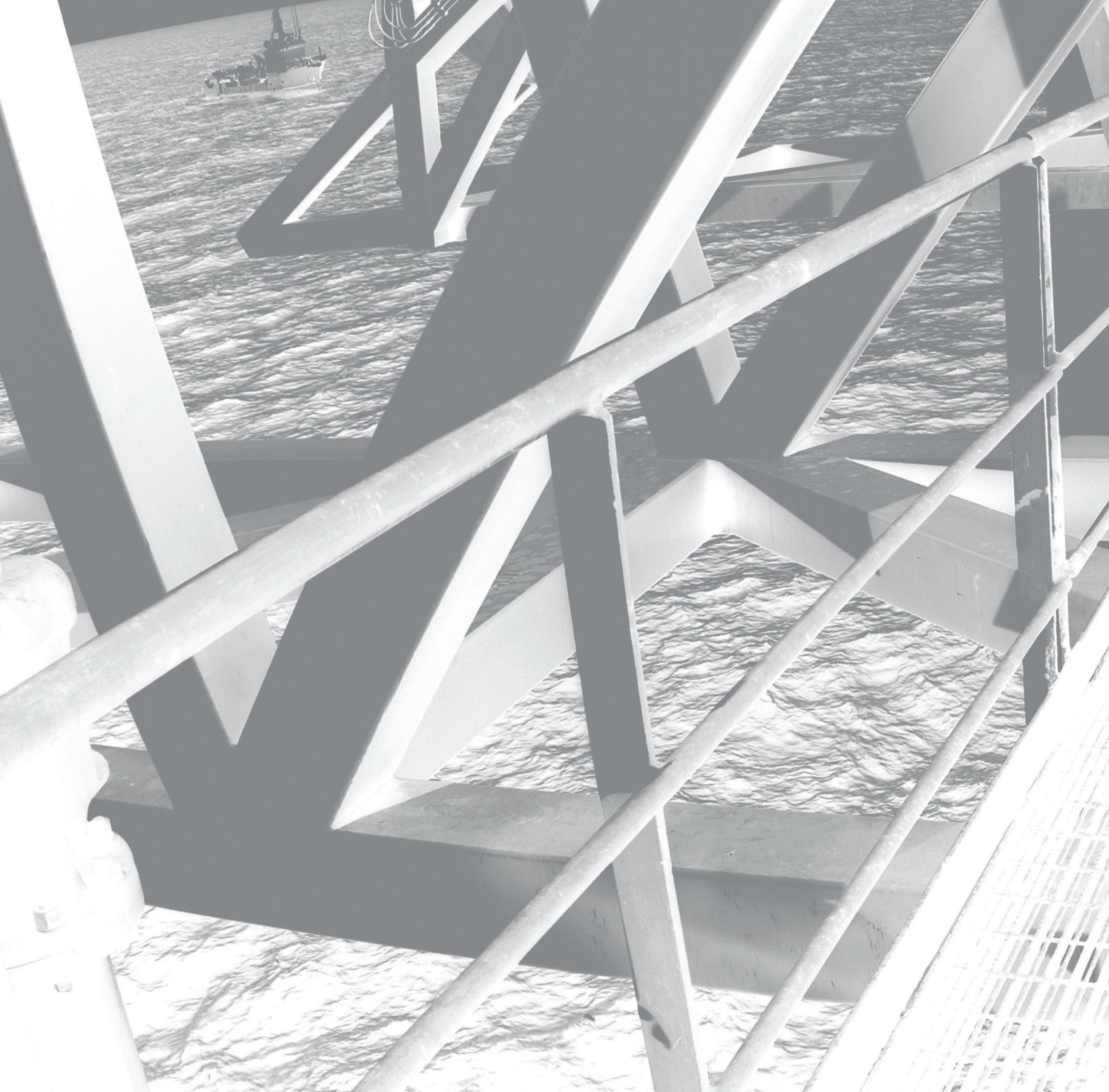

OIL&GAS UK

Contents

1. Foreword

Welcome to the Oil & Gas UK *Environment Report 2016*, which contains a comprehensive picture of the environmental performance of the UK offshore oil and gas industry up to the end of 2015. The publication comes at a particularly tough time for the sector, which is doing its utmost to manage its way through the downturn, efficiently, while maintaining environment and safety standards.

Data and analysis of emissions to atmosphere, discharges to sea, accidental oil and chemical releases, and waste disposal are captured in this annual report, gathered via metrics set by the regulators. What is shown is a continuation of positive performance by industry against a backdrop of older assets, a mature basin and production upturn.

Last year's production increase was the first in 15 years. The extraction of more oil and gas resulted in a slight rise in 2015 in the mass of production chemicals discharged and produced water volumes, as well as in emissions of carbon dioxide, nitrogen oxides, carbon monoxide and sulphur dioxide. However, the proportion of the rise was not as great as the production increase itself, demonstrating industry's commitment to environmental management and its determination to minimise emissions as far as possible.

Carbon dioxide emissions (CO_2) from UK offshore oil and gas production contributed just over 3 per cent of the UK's total CO_2 emissions in 2015. In fact, the largest fall in the UK of CO_2 emissions was seen in the energy supply sector, according to UK Government figures.

Discharges of produced water – water that is brought to the surface with hydrocarbons during production – have fallen overall by 37 per cent since 2000, with the average oil in water concentration last year less than half of the recommended limit set by the OSPAR Commission.

Industry makes every effort to prevent accidental oil and chemical releases, and last year saw the smallest mass of accidental oil released to the marine environment on record. While there was a slight rise in the mass of chemicals accidentally released last year, almost half was the result of three incidents. Individual releases were generally smaller than previous years and the overall mass of chemicals released from 2010 to 2015 has fallen by 65 per cent.

Management of the offshore environment is stringently regulated by domestic and EU regulations. Our report comes as the sector awaits details of the UK's future relationship with Europe, while our focus and commitment to safety and the environment remain.

We hope you find Oil & Gas UK's 2016 *Environment Report* both helpful and informative. Any queries on content or feedback should be directed to Mick Borwell, Oil & Gas UK's Health, Safety and Environment Policy Director on mborwell@oilandgasuk.co.uk.

Mick Borwell
Oil & Gas UK's Health, Safety and Environment Policy Director

2. Executive Summary

The UK offshore oil and gas industry is a major hazard sector and is committed to maintaining operations that minimise the effect on the natural environment. Environmental performance is monitored using a number of metrics.

Industry Emissions and Discharges

- The Department for Business, Energy and Industrial Strategy (BEIS) regulates all emissions and discharges from the UK Continental Shelf (UKCS) and operators must apply for a permit to produce emissions to air or discharges to sea. As part of the permit application, the potential environmental effects and any mitigation measures need to be considered.

- Discharges and emissions are closely monitored offshore by operating companies and are recorded in the Environmental Emissions Monitoring System (EEMS)[1] database. Since 2000, there has been an overall downward trend in discharges and emissions. This mirrors the decline in UKCS oil and gas production, but it is also the result of process management and application of the best available techniques by industry.

- In 2015, however, the production upturn for the first time in 15 years resulted in a rise in produced water volumes, production chemicals discharged to sea and in atmospheric emissions, although this was proportionally less than the 10 per cent increase in production, reflecting the industry's commitment to environmental management.

- Produced water comes to the surface with hydrocarbons during production. Last year, the increase in production resulted in a rise in the volumes of produced water handled on the UKCS to 202 million cubic metres. This is a 7.5 per cent increase in produced water compared with the 10.4 per cent growth in production. It is also important to note that hydrocarbons are harder to reach and extract in a mature basin generating large volumes of produced water.

- Since 2000, however, there has been an overall 37 per cent decrease in the volume of produced water discharged to sea from 263 million cubic metres to 165 million cubic metres.

- The average concentration of oil discharged with produced water across the industry was 14.2 milligrammes/litre last year – less than half the OSPAR[2] recommended limit. Around 2,300 tonnes of oil were discharged with produced water, accounting for just over 0.001 per cent of the total mass of produced water discharged.

- The average concentration of naturally occurring radioactive materials (NORM) in produced water remains consistently and significantly below the 0.1 Bequerel per millilitre (Bq/ml) limit by an order of one hundred. Operators are required to notify the relevant environment agency for levels above 0.1 Bq/ml.

- Seventy-two per cent (approximately 74,000 tonnes) of the total chemical discharges on the UKCS (just over 102,500 tonnes) in 2015 were classified as those that Pose Little Or NO Risk (PLONOR) to the environment. Just 6 per cent (around 6,100 tonnes) had a substitution (SUB) warning[3].

[1] See www.gov.uk/guidance/oil-and-gas-eems-database
[2] The OSPAR Commission aims to protect and conserve the North East Atlantic and its resources. See www.ospar.org
[3] SUB chemicals are those classified as harmful under the Offshore Chemical Notification Scheme. These substances should be phased out and substituted with a less harmful chemical. See http://bit.ly/SUBchemicals

- The total amount of pipeline and drilling chemicals discharged in 2015 declined year-on-year by over 6 per cent to just under 74,000 tonnes combined. The decrease in pipeline chemicals was due to fewer major projects being carried out on the UKCS in that year, while the reduction in drilling chemicals reflects the decline in drilling activity as only 155 wells were drilled last year.

- The amount of production chemicals discharged rose in line with the upturn in production by 8 per cent to 28,500 tonnes. Overall, the mass of production chemicals used on the UKCS has been declining since the mid-2000s.

- In 2015, the same mass of chemicals was used in the production of more hydrocarbons. One tonne of production chemical produced 2,875 tonnes of oil equivalent compared with 2,797 tonnes of oil equivalent in 2014. This reflects improved performance from existing fields, as well as new fields with more efficient technology coming on-stream.

- In 2015, carbon dioxide equivalent (CO_2e) greenhouse gas (GHG) emissions from UK offshore oil and gas production contributed just over 3 per cent of the total UK emissions – the same level as in 2014[4].

- Emissions of carbon dioxide (CO_2), nitrogen oxides, carbon monoxide and sulphur dioxide have increased in 2015 by 5 per cent to 13.3 million tonnes combined, of which 13.2 million tonnes are CO_2 emissions, reflecting again last year's rise in production. Nevertheless, emission levels are still well below what they were prior to 2013, continuing a downward trend over the longer term.

- Around three quarters of the CO_2 emissions offshore came from fuel to power combustion equipment generating electrical power for lighting, heating, refrigeration etc, and to drive compressors for gas export.

- Exploration, production and transport of hydrocarbons make up a small percentage of overall oil and gas life cycle emissions – approximately 9 per cent for oil and 16 per cent for gas[5].

- Since 2013, the emissions per unit of production have begun to fall. This trend continues in 2015 with a carbon emission intensity of just under 22,000 tonnes per million barrel of oil equivalent[6]. This is despite the production increase last year, indicating a continued decline in the carbon emission intensity of offshore production.

- In 2015, 41,200 tonnes of methane were emitted from offshore installations – a 30 per cent net reduction since 2000; while 37,200 tonnes of volatile organic compounds (VOCs) were emitted – a reduction of over 53 per cent since 2000. Methane and VOCs account for 72 per cent of flaring emissions and 81 per cent of venting emissions.

- Gas flaring and venting are carried out on the UKCS for a variety of reasons, predominantly for safety. Central and northern North Sea platforms flare the most amount of gas because of the prominence of oil platforms in these locations, while the southern North Sea gas platforms carry out more venting. Older platforms were designed to flare gas and so higher levels can be seen from platforms that are over 30 years old. Newer installations are designed to flare much lower levels of gas.

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[4] See http://bit.ly/GHGe2015

[5] See http://bit.ly/GHGvNG. The data came from the US. UK data could not be sourced.

[6] Source: EEMS. This covers all installations on the UKCS that report emissions to BEIS, which includes some mobile installations and installations not reportable under the EU Emissions Trading System. Therefore, the number of CO_2 emissions quoted here is higher than in the Oil & Gas UK *Economic Report 2016*.

- Around 218,500 tonnes of waste materials were returned to shore from the UKCS in 2015. This represents a 15 per cent increase on the 190,000 tonnes of waste in the previous year and continues the overall increasing trend since the mid-2000s. The increase in 2015 is predominantly due to sludges, liquids and tank washings from mobile drilling rigs that are taken off hire. Just under 52,000 tonnes of the total waste returned to shore were recycled.

Accidental Releases

- The UK offshore oil and gas industry does its utmost to prevent accidental oil and chemical releases by investing heavily in maintenance to minimise leaks; introducing physical barriers such as downhole safety valves; and by developing handling procedures and training that influence human behaviours. In the event of an accidental oil release, operators have approved emergency response plans in place and use a wide range of response techniques to monitor, contain and recover releases.

- Determining the oil product type enables understanding of how the release will behave in the marine environment under varying conditions. Diesel and light oils will rapidly break up and evaporate when they are released. More persistent oil types, such as crude oil, will be monitored and response operations take place as appropriate.

- Last year saw the smallest mass of accidental oil released to the marine environment on record at just under 17 tonnes.

- No individual release was greater than 2.2 tonnes and, with 243 releases in total, there were 66 fewer releases in 2015 than in 2014.

- Eighty-two million tonnes of oil equivalent were produced in 2015, meaning that accidental oil releases represented less than 0.00002 per cent of total oil production.

- Crude oil accounted for 44 per cent of released product by mass between 2010 and 2015, with condensate accounting for 38 per cent. The latter was predominately due to a single event in 2012.

- In 2015, lubricating oil and crude oil made up the largest mass of releases at 19 per cent (3.2 tonnes) and 18 per cent (3.0 tonnes), respectively.

- Over 50 per cent of accidental oil releases last year came from production systems. There were 58 releases from 20 operators in this category, averaging 0.15 tonnes for each release.

- Industry continues to focus on reducing accidental oil and gas releases through improved maintenance and monitoring, as well as the use of new technology.

- Just over 225 tonnes of chemicals were accidentally released on the UKCS in 2015 – a 25 per cent increase since 2014. However, around 100 tonnes of these accidental releases can be attributed to three incidents. The overall number of incidents fell by 19 in 2015 to 167.

- In 2015, approximately 372,800 tonnes of chemicals were used on the UKCS. Accidental releases accounted for 0.06 per cent of these.

- Overall, the mass of chemicals accidentally released has fallen by more than 400 tonnes or 65 per cent over the last six years (2010 to 2015). The number of incidents has remained relatively stable, increasing from 162 to 167. This would suggest that accidental releases are generally smaller in size than in previous years.

- Sixty-six per cent (around 148 tonnes) of all accidental chemical releases on the UKCS last year fell into the low and PLONOR hazard categories. Seven incidents accounting for 20 per cent (nearly 46 tonnes) of total mass fell into the high hazard category. Chemicals in this category were predominantly composed of water with 0.36 tonnes of high hazard chemical. Such small amounts disperse quickly in the marine environment.

- Between 2010 and 2015, production systems and related equipment contributed the majority (1,132 tonnes, 454 releases) of all accidental chemical releases, with hydraulic and subsea systems accounting for 596 tonnes (278 releases) and 517 tonnes (205 releases), respectively. Together, these three categories account for over 76 per cent of accidental releases by mass over the past six years.

- In 2015, however, subsea system and hydraulic system releases contributed the most to the chemicals released by mass, with production systems contributing relatively little. It is notable, however, that production systems had the largest number of releases at 87.

Significant Activities

- The Health, Safety and Environment Team at Oil & Gas UK helps members manage the regulatory pressures emerging from governments that affect the licence to operate. As part of this work, in 2016, Oil & Gas UK co-ordinated responses to seven consultations relating to the marine environment on behalf of its members.

- Oil & Gas UK works with members and other stakeholders to generate tools and guidelines to support good industry environmental performance. This year, the association has worked with members of the Oil Spill Response Forum on three new tools: maps of coastal habitat, flora and fauna sensitive to oil spills; updates to the *Seabird Oil Sensitivity Index*; and improving understanding of the UK’s capability to monitor an accidental release.

3. Offshore Emissions and Discharges

The Department for Business, Energy and Industrial Strategy (BEIS) regulates the industry's offshore emissions and discharges. UK Continental Shelf (UKCS) operators must apply for a permit to produce emissions to air or discharges to sea and any discharges and emissions must be reported to BEIS through the Environmental Emissions Monitoring System (EEMS) database. As part of the permit application, companies must consider the potential environmental effects and any mitigation measures.

As a mature basin, the UKCS faces several challenges, including how to continuously improve environmental performance and efficiency as production of oil and gas becomes more technically difficult. Production peaked in 2000 at 1,719 million barrels of oil equivalent (boe) and has since declined. However, a combination of production efficiency[7] improvements in existing assets, field restarts and new start-ups resulted in the first upturn in output in 15 years last year by over 10 per cent when just over 600 million boe were produced[8].

This chapter analyses the UKCS' environmental performance and the impact of the increase in production in 2015. A comparison with Norwegian[9] and international[10] data is provided where possible to offer additional context to the UK data.

3.1 Produced Water

Produced water comes to the surface with hydrocarbons during production. The water is separated from oil and gas on the installation during the first stages of processing and discharged to sea after treatment. Operators gain approval for produced water discharge by applying for an oil discharge permit under the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (as amended in 2011)[11].

Produced Water Volumes

The total amount of produced water handled on the UKCS tends to follow the general trend of production and has therefore been declining in recent years (see Figure 1 opposite). Although, over time, the decline in production has been greater than the decrease in produced water. This is because hydrocarbons are harder to reach and extract in a mature basin generating larger volumes of produced water.

Last year, the increase in production gave rise to 202 million cubic metres of produced water, accounting for 69 per cent of the total well stream fluids[12]. Nevertheless, as a proportion, this is a 7.5 per cent increase in produced water compared with the 10.4 per cent growth in production, indicating that management measures and the best available techniques are being implemented to minimise discharges of produced water as far as possible.

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[7] Production efficiency is the total annual production divided by maximum production potential.

[8] As recorded in BEIS *Energy Trends Bulletin* at www.gov.uk/government/collections/energy-trends

[9] The Norske Olje & Gass 2014 *Environmental Report* is available to download at http://bit.ly/NOGenvironmental

[10] The International Association of Oil & Gas Producers (IOGP) *Environmental Performance Indicators* – Data are available to download at www.iogp.org/pubs/2014e.pdf

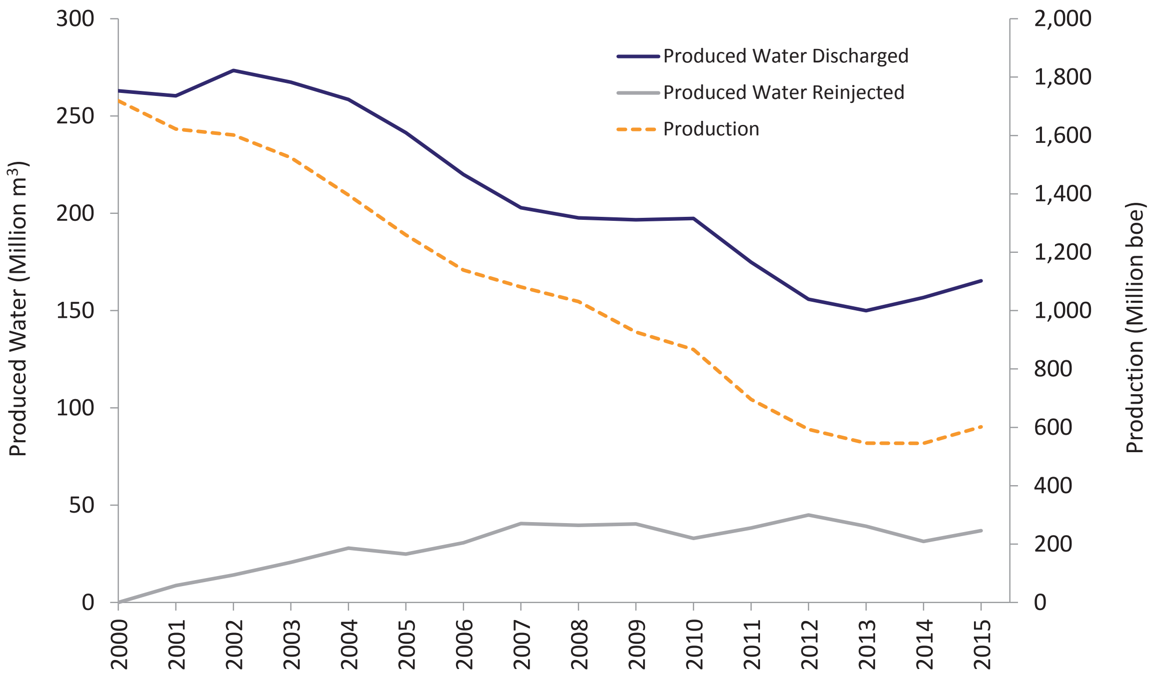
[11] See http://bit.ly/OPAreg05

[12] A term used to describe the total mass of fluids moving through the production systems. This includes produced water and oil in produced water; the produced water and oil reinjected; the total hydrocarbons produced (gas, oil and condensate). Source for all these variables is EEMS data.

Since 2000, the volume of produced water discharged to sea decreased by 37 per cent, from 263 million cubic metres to 165 million cubic metres.

Reinjection of produced water into suitable subsurface strata or the reservoir itself, where technically feasible, is an alternative to discharge to sea. Reinjection of produced water has been carried out on the UKCS since 2001 and about 18 per cent (almost 37 million cubic metres) of the total produced water in 2015 was reinjected. This is an increase on 2014, but is consistent with the general trend since 2009 with approximately one fifth of the total volume of produced water being reinjected.

Figure 1: Total Produced Water Discharged to Sea and Reinjected versus Production



Source: EEMS July 2016, BEIS

International Comparison

The International Association of Oil & Gas Producers (IOGP) reports that globally 0.6 tonnes of produced water were discharged and 1.2 tonnes were reinjected per tonne of hydrocarbon produced (both onshore and offshore) by IOGP member companies in 2014[13]. Ninety-two per cent of the reported produced water came from offshore operations.

Comparatively, in 2014, the UKCS discharged 2.1 tonnes and reinjected 0.4 tonnes of produced water per tonne of hydrocarbon produced. In 2015, these values decreased slightly to 2 tonnes and 0.4 tonnes, respectively. This highlights the UKCS' maturity and its technically challenging environment compared with many other basins around the world. It is therefore to be expected that more produced water is generated in the UK than on average globally.

Norwegian data show similar trends to the UK with a general increase in the ratio of produced water to hydrocarbon production. Both countries face similar technical challenges with production in the North Sea. In 2015, the UKCS generated 2.4 tonnes of produced water per tonne of hydrocarbon. In Norway, this figure is about 2.3 tonnes and, similar to the UK, 20 per cent of the total produced water is, on average, reinjected into the subsurface.

[13] 2015 data are not available at the time of publishing.

Produced Water Composition

Produced water accumulates small amounts of naturally occurring substances through contact with the reservoir rock, including dispersed oil, dissolved organic compounds and naturally occurring radioactive materials (NORM). Trace production chemicals are also present. If discharged with produced water, these chemicals rapidly dilute within the marine environment. The type and composition of chemicals is determined by the reservoir geology, maturity and production life stage.

Oil in Produced Water

In 2015, around 2,300 tonnes of oil were discharged with produced water, making up just over 0.001 per cent of the total mass of produced water discharged – the same as in 2013 and 2014. OSPAR[14] Recommendation 2001/1 requires that individual installations do not exceed an average annual oil in water concentration of 30 milligrammes per litre (mg/l). In 2015, the average concentration across the industry was less than half, at 14.2 mg/l, measured using the GC-FID method[15]. This is a slight increase on 2014, but maintains the general trend since data have been recorded using this method (see Figure 2 opposite).

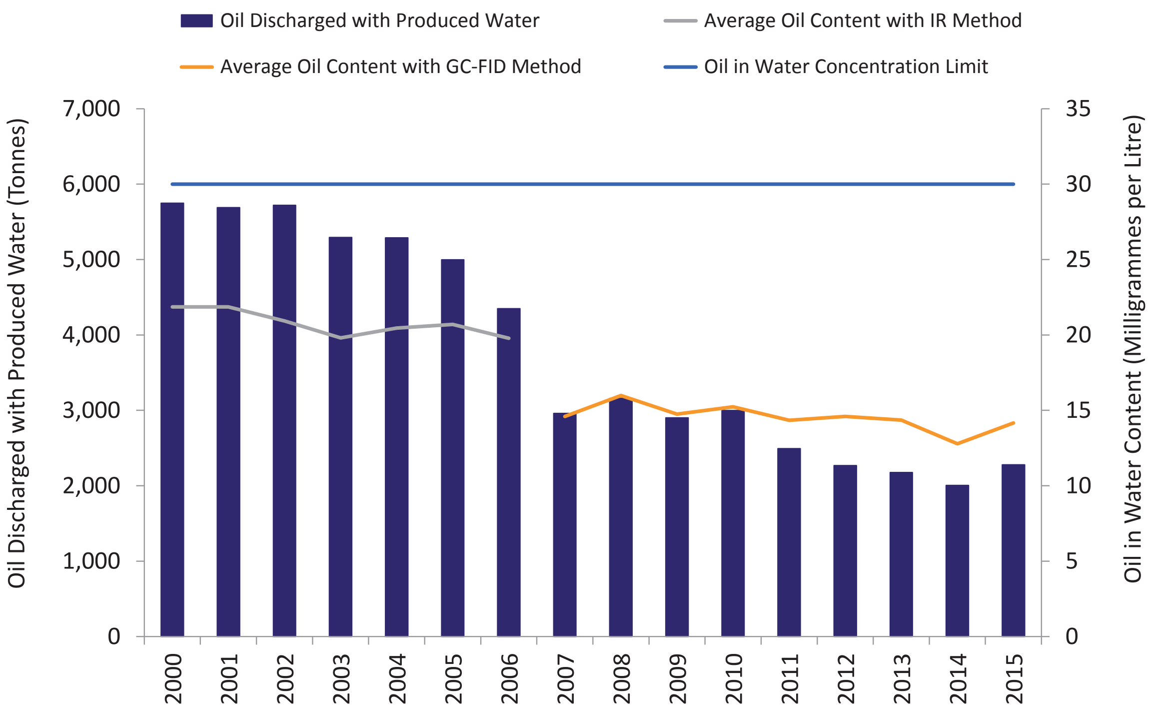
At such low concentrations, the impact of the oil discharged in produced water on the marine environment is considered to be very small as the fluids disperse rapidly and are greatly diluted in the North Sea. Small amounts of oil are able to be quickly broken down by naturally occurring bacteria.

The IOGP reports that the global average oil content in produced water from offshore installations in 2014 was 12.8 mg/l. In Norway, the concentration of oil in produced water increased steadily from 2000 to 2014 then dropped slightly last year to 12.3 mg/l. Norske Olje & Gass reports that a total of 1,819 tonnes of oil were discharged with produced water on the Norwegian Continental Shelf in 2015. The 2014 UKCS average concentration was 12.8 mg/l and despite the slight increase in 2015 remains largely comparable to both the global and Norwegian values.

[14] The OSPAR Commission aims to protect and conserve the North East Atlantic and its resources. See www.ospar.org

[15] Up to 2006, oil concentration in produced water was measured using the infrared method (IR). The IR method measures, in solvent, both the dispersed and dissolved hydrocarbons extracted. This method can, however, include other organic chemicals, giving an artificially high result and can also underestimate dissolved hydrocarbons. To rectify this and to provide a more accurate analysis of hydrocarbon content, OSPAR agreed (Agreement 2005-15) the use of a new method for oil in water analyses, based on a modified version of the ISO 9377-2 (GC-FID) method.

Figure 2: Oil Discharged with Produced Water to Sea



Source: EEMS July 2016

Naturally Occurring Radioactive Materials (NORM)

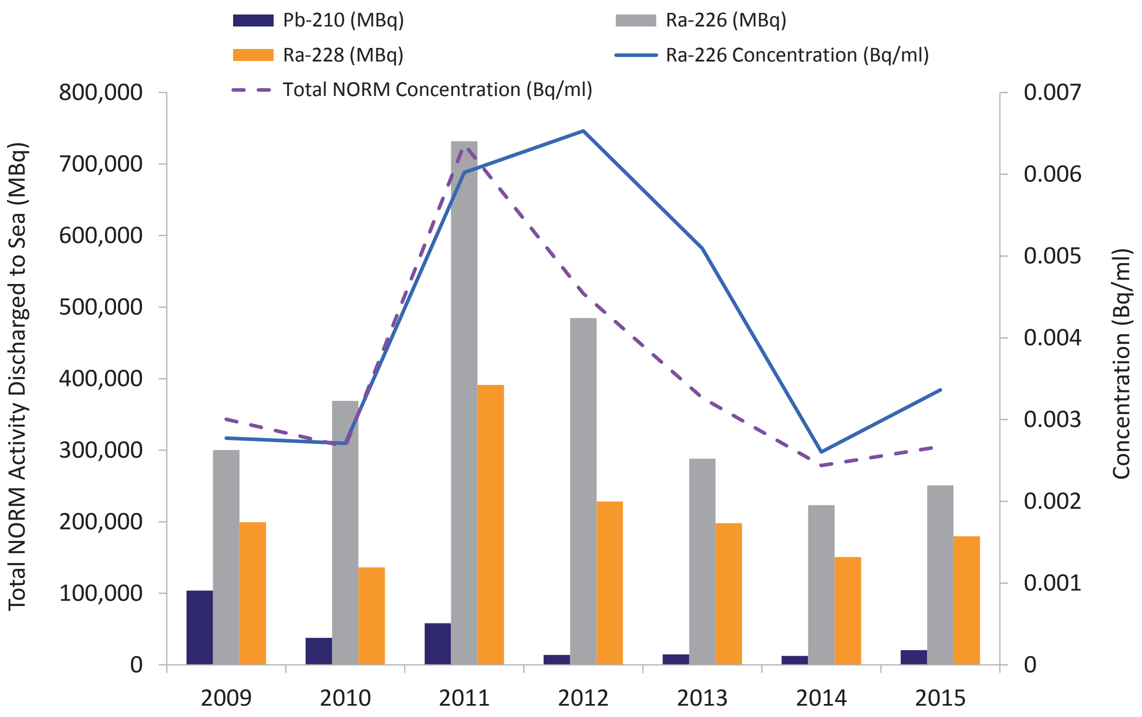
Discharges of NORM are controlled through permits issued under the Radioactive Substances Act (RSA) 1993[16]. Radium and many other radionuclides occur naturally in seawater and have done so for millions of years. The UKCS rock strata contains radionuclides of the uranium and thorium decay series and some of these dissolve into the water in the reservoir. These do not have a significant impact on the marine environment or human health. Permits for offshore reinjection or discharge of produced water are approved on the condition that the operator notifies the relevant environment agency if the concentration of Ra-226 is greater than 0.1 becquerel per millilitre (Bq/ml)[17].

Total NORM activity is measured in megabecquerel (MBq). Figure 3 overleaf shows a slight increase in the amount of NORM discharged in 2015. The amount discharged is almost wholly dependent on the reservoir conditions and the volume of produced water discharged; the latter correlates to production so the increase in NORM discharged is expected. Despite this rise, the average Ra-226 concentration and the average total NORM concentration remain consistently and significantly below the 0.1 Bq/ml limit by an order of a hundred.

[16] The RSA 1993 is available to view at www.legislation.gov.uk/ukpga/1993/12/contents

[17] The *Strategy for the Management of Naturally Occurring Radioactive Material (NORM) Waste in the United Kingdom* is available to download at www.gov.scot/Resource/0045/00455971.pdf

Figure 3: Breakdown of NORM Discharged in Produced Water



Source: EEMS July 2016

3.2 Chemicals

Discharge of chemicals into the marine environment is regulated in the UK through the Offshore Chemical Regulations 2002 (as amended 2011)[18]. The offshore oil and gas industry uses chemicals in the exploration and production of hydrocarbons. Usage is kept strictly to the amounts required for the designated task to avoid waste and to reduce environmental impact. BEIS must permit all discharges in advance.

Only chemicals that have been registered with the Centre for Environment, Fisheries and Aquaculture Science's (CEFAS) Offshore Chemical Notification Scheme (OCNS) are permitted for use and discharge. The OCNS applies the OSPAR Harmonised Mandatory Control Scheme (HMCS), developed through OSPAR Decision 2002/2 (as amended by OSPAR Decision 2005/1) and its supporting recommendation. The OSPAR HMCS contains a list of chemicals that it considers to pose little or no risk (PLONOR) to the environment, as well as those for which there is a substitution warning (SUB)[19] and a less environmentally hazardous alternative should be used if practicable. Further information on chemical use regulation is given in the appendix.

[18] The Offshore Chemical Regulations are available to view at http://bit.ly/OCreg02. The 2011 Amendment is available to view at http://bit.ly/OCamend11

[19] SUB chemicals are those classified under OCNS as harmful and should be phased out and substituted with a less harmful substance. See http://bit.ly/SUBchemicals

Mass of Chemicals Discharged

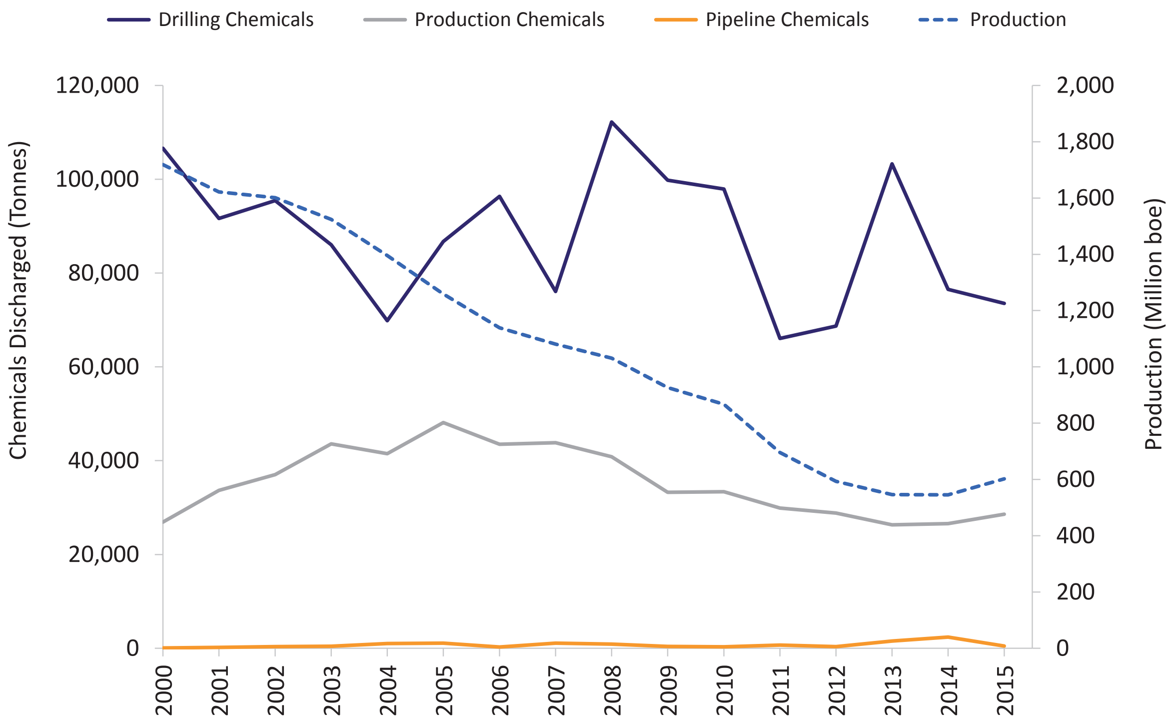
In 2015, just over 102,500 tonnes of chemicals were discharged to the marine environment (around 170 tonnes per million boe produced), of which almost 72 per cent (73,500 tonnes) were from drilling activities. This is compared with 105,500 tonnes of chemicals discharged in 2014, of which 73 per cent were from drilling activity.

While the total amount of chemicals discharged is consistently dominated by drilling chemicals, the amount of drilling chemicals released has fallen by over 30 per cent since 2000 (see Figure 4). Furthermore, coinciding with the long-term reduction in drilling activity, there has been a net decrease of almost 39,000 tonnes in drilling chemicals discharged since a peak in 2008. The increase in 2013 is due to more complex wells being drilled and is out of step with the general downward trend.

Specialist chemicals are used in the production of oil and gas to maintain equipment integrity and optimise production. These chemicals include demulsifiers to improve oil separation from water; corrosion inhibitors to protect equipment; scale inhibitors to slow down scale build-up in pipework and valves; and biocides to reduce marine growth on equipment. Since 2011, the amount of production chemicals discharged has varied with production, having decreased, plateaued, and then started to increase in 2015. Last year, 28,500 tonnes of production chemicals were discharged representing an 8 per cent increase on 2014.

Pipeline chemicals are used for pipeline maintenance and include biocides and oxygen scavengers. 2014 saw eight pipelines contribute to the ten largest discharges, all of which were either new or undergoing major repair works. Following completion of these works, 2015 figures show that pipeline chemical use has returned to a level consistent with recent years and discharges are at their lowest level since 2012.

Figure 4: Production, Drilling and Pipeline Chemicals Discharged



Source: EEMS July 2016

Just over 72 per cent (74,000 tonnes) of the total discharges in 2015 were PLONOR. Furthermore, all discharged chemicals dilute to levels that are not acutely toxic to marine organisms.

For all chemical types, significantly more are used or returned to shore than are discharged. Four times as many drilling chemicals are used than discharged, double the amount of pipeline chemicals are used and 1.5 times the amount of production chemicals. Those that are not used or discharged are returned to shore for reuse or disposal through various waste processing routes.

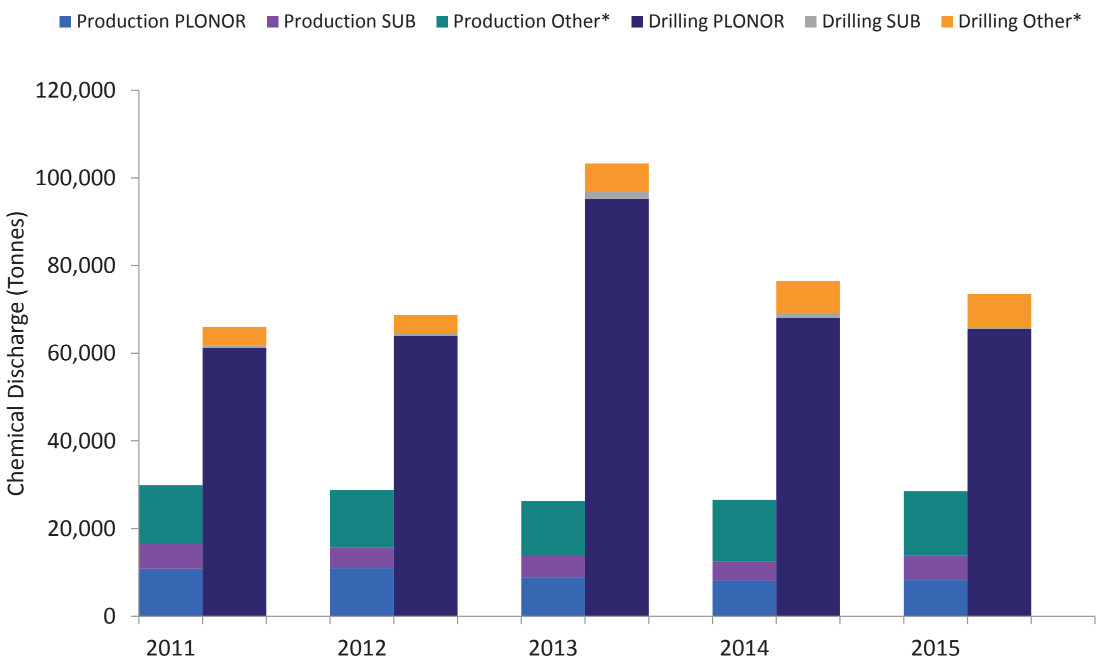
The OSPAR *Quality Status Report 2010*[20] evaluates the impact of human activity on the marine environment. The report stated that a third of OSPAR priority chemicals[21] are expected to be phased out in the OSPAR area by 2020 if current efforts continue. By working to reduce offshore chemical discharges, the oil and gas industry is supporting efforts to minimise the impact to the North Sea.

Composition of Chemicals Discharged

While nearly three quarters of the total chemicals discharged on the UKCS were PLONOR, just six per cent (around 6,100 tonnes) were classified as SUB. The OSPAR Recommendations 2006/3[22] on environmental goals require the use of SUB chemicals to be phased out where practical by 2017. Operators in the UK are looking for alternative products and the technical feasibility of their use. The remaining chemicals fall into other hazard categories and all were discharged under permit.

An increase in the use of production SUB chemicals was seen in 2015 in line with the rise in production. The number of different chemicals used, however, reached a low of 184, down from 216 in 2011, showing that operators are working to eliminate the use of these chemicals.

Figure 5: A Breakdown of Drilling and Production Chemicals Discharged by Classification

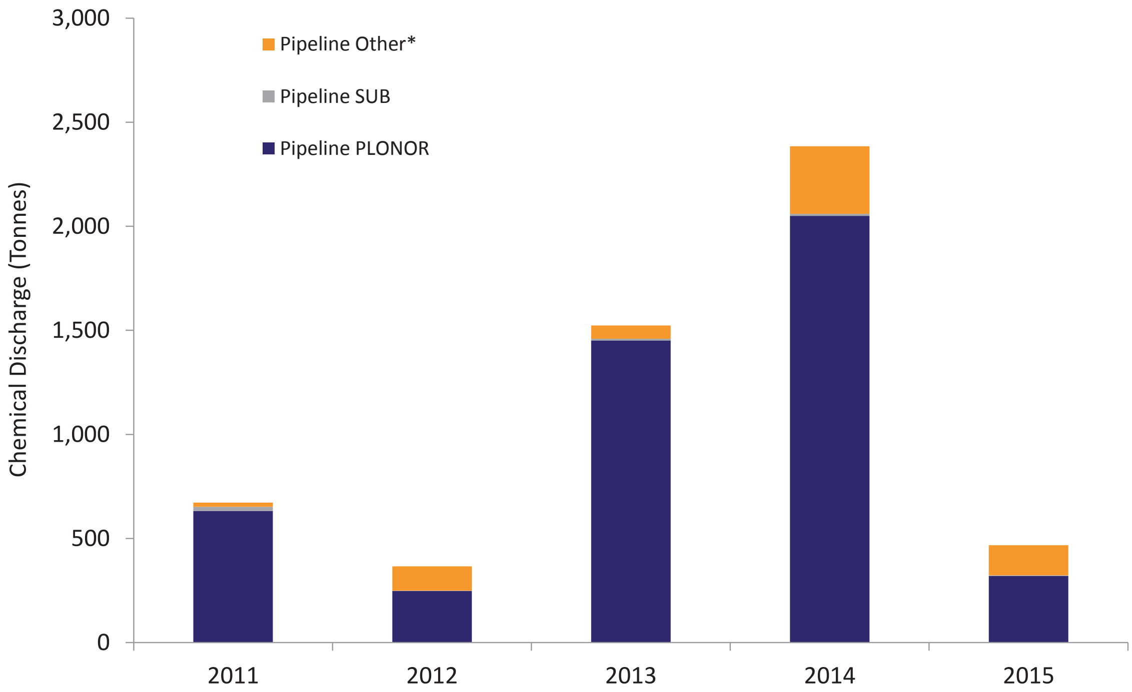


* Other includes those chemicals reported in EEMS that are not classified as PLONOR or SUB but all chemicals have a permit to be discharged.

Source: EEMS July 2016

[20] The OSPAR *Quality Status Report 2010* is available to download at http://qsr2010.ospar.org/en/index.html
[21] See www.ospar.org/work-areas/hasec/chemicals/priority-action
[22] See http://www.ospar.org/documents?v=7336

Figure 6: A Breakdown of Pipeline Chemicals Discharged by Classification



* Other includes those chemicals reported in EEMS that are not classified as PLONOR or SUB but all chemicals have a permit to be discharged.

Source: EEMS July 2016

By comparison, just over 157,000 tonnes of chemicals were discharged on the Norwegian Continental Shelf in 2015, a slight decrease on 2014 when 166,000 tonnes were discharged[23]. Of those, 91 per cent fell into the green category (chemicals considered to have no or limited environmental impact) and red and black[24] made up 0.046 per cent of the total discharged (67 tonnes and 6.6 tonnes, respectively).

3.3 Drill Cuttings

Drill cuttings are rock fragments generated during well drilling offshore. These are carried back to the surface by a drilling fluid. Drilling fluid can either be water-based or oil-based and is reused on the rig after separation from the cuttings. The cuttings, which are coated in drilling fluid, are disposed of according to the type of fluid – water- or oil-based.

The choice and composition of drilling fluid depends on the characteristics of the rock strata and consideration of the safety and environmental risks. Oil-based fluid is likely to be used in technically challenging sections of the well, or where a well is being drilled at an angle rather than vertically.

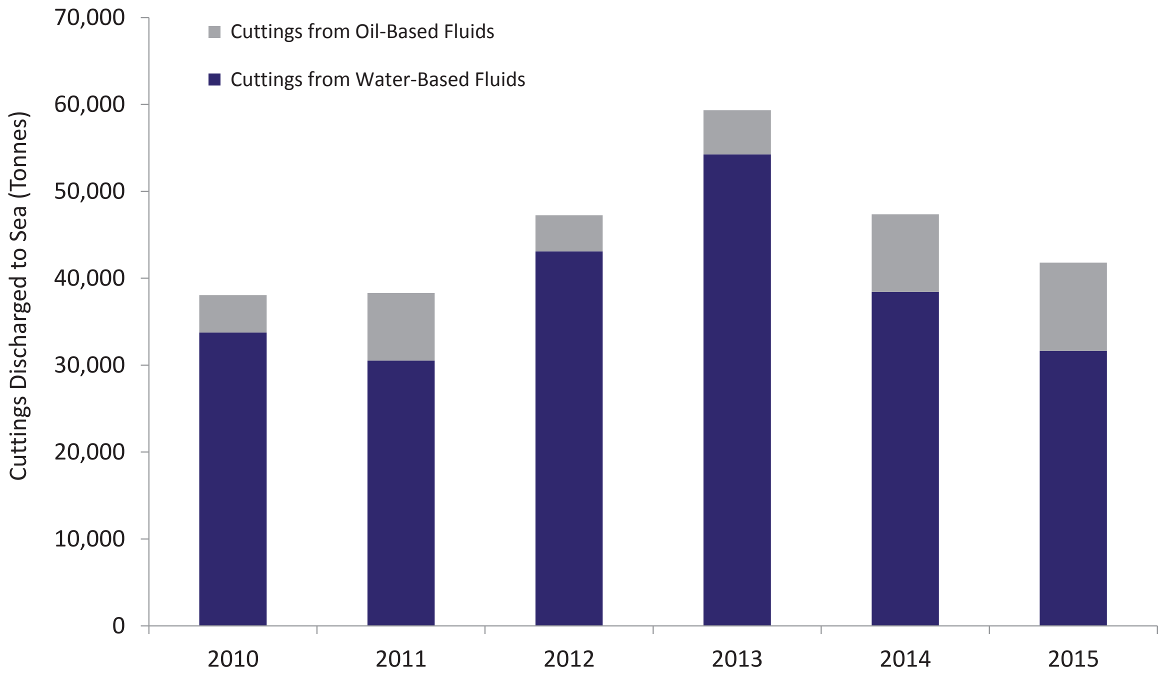
Water-based fluid drill cuttings are generally permitted to be discharged to sea. Since 2001, following OSPAR decision 2000/3, oil-based fluid cuttings cannot be discharged to sea unless they are treated to reduce the oil content to below 1 per cent of the total mass. In advance of any discharge, operators must conduct an assessment to investigate the potential environmental effects as part of their permit application to BEIS.

[23] See http://bit.ly/NOGevn16
[24] See http://bit.ly/OsparR14

Just over 31,000 tonnes of water-based fluid cuttings and around 10,000 tonnes of treated oil-based fluid cuttings were discharged from offshore installations on the UKCS in 2015. This is approximately 5,500 tonnes less than was discharged in total the previous year, reflecting the decline in cuttings generated due to reduced drilling activity. The peak in cuttings discharged in 2013 in Figure 7 is due to more complex wells being drilled and is out of step with the general downward trend in drilling.

Over 10,000 tonnes of oil-based fluid cuttings were also injected back into the reservoir (compared with 7,400 tonnes in 2014), which means the amount returned to shore last year declined from 82 per cent of the total oil-based fluid cuttings to 76 per cent in 2015.

Figure 7: Drill Cuttings Discharged to Sea



Source: EEMS July 2016

Norske Olje & Gas reported a 13 per cent reduction in water-based fluid cuttings discharged to sea on the Norwegian Continental Shelf to just under 100,000 tonnes in 2015. Injection of oil-based fluid cuttings increased from 29 per cent of total oil-based fluid cuttings in 2014 to 33 per cent, while 2,460 tonnes of oil-based fluid cuttings were discharged to sea.

3.4 Atmospheric Emissions

The extraction, stabilisation and export of hydrocarbons involve several processes that give rise to atmospheric emissions. These include combustion to provide electrical power and drive compressors and pumps; flaring of excess gas for safety and during well testing; and incidental releases from tank loading, as well as firefighting and refrigeration equipment.

Combustion and flaring result in emissions of carbon dioxide (CO_2), carbon monoxide (CO), methane (CH_4) and oxides of nitrogen (NO_x) and sulphur (SO_x). Small amounts of nitrous oxide (N_2O) are also emitted. Releases of volatile organic compounds (VOCs) and CH_4 may occur during tank loading, while firefighting may release halons.

The Kyoto Protocol defines six greenhouse gases (GHG) including CO_2, CH_4, N_2O, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF_6). It is generally accepted that GHG emissions are contributing to anthropogenic global climate change. GHG emissions stem from a number of sources such as hydrocarbon combustion, including those emissions generated through oil and gas operations.

Atmospheric emissions from the offshore oil and gas industry are controlled by several pieces of legislation that require operators to undertake emissions monitoring, reporting and management measures. There are over 20 atmospherics-related European legal instruments[25] that are applicable to various different sites in the oil and gas industry, such as the EU Emissions Trading System (ETS), carbon tax, strict flaring restrictions, emission and discharge permits, and the requirement to use the best available techniques (BAT) and to assess power from shore for new developments. Further information on the regulation of atmospheric emissions is given the appendix.

Atmospheric Emissions in Context

Provisional BEIS data show that 497 million tonnes of CO_2 equivalent (CO_2e) GHG emissions were emitted in the UK in total in 2015 – down 3 per cent from 2014 – of which 405 million tonnes were CO_2 emissions[26]. The largest fall in CO_2 emissions came in the energy supply sector (13 per cent reduction) given the change in fuel mix for electricity generation and lower coal usage.

In 2015, 14.7 million tonnes of CO_2e GHG emissions were released on the UKCS – 3 per cent of total UK emissions – of which 13.2 million tonnes were CO_2 emissions[27]. This is comparable to the Norwegian Continental Shelf, where 14.2 million tonnes of CO_2e were emitted last year[28].

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[25] Since the UK voted to leave the EU, Oil & Gas UK is working with its members to make this transition as smooth as possible to maintain our world-class and robust environment regime on the UKCS.

[26] See http://bit.ly/GHGe2015

[27] Source is EEMS. This covers all installations on the UKCS that report emissions to BEIS, which includes some mobile installations and installations not reportable under the EU Emissions Trading System. Therefore, the number of CO_2 emissions quoted here is higher than in Oil & Gas UK's *Economic Report 2016*.

[28] See http://bit.ly/NOGevn16

Trend Data

Figure 8 shows that in general there has been a steady decline in CO_2, CO, NO_x and SO_2 emissions from UK offshore oil and gas installations since 2000. The decline in production over the long term has been influential in reducing emissions, as has been lower emissions from new fields that have come on-stream using more efficient technology.

Emissions of CO_2, CO, NO_x and SO_2 have, however, increased in 2015 by 5 per cent to 13.3 million tonnes combined, reflecting the growth in production last year. Nevertheless, emission levels are still well below what they were prior to 2013 and so there continues to be a downward trend over the longer term.

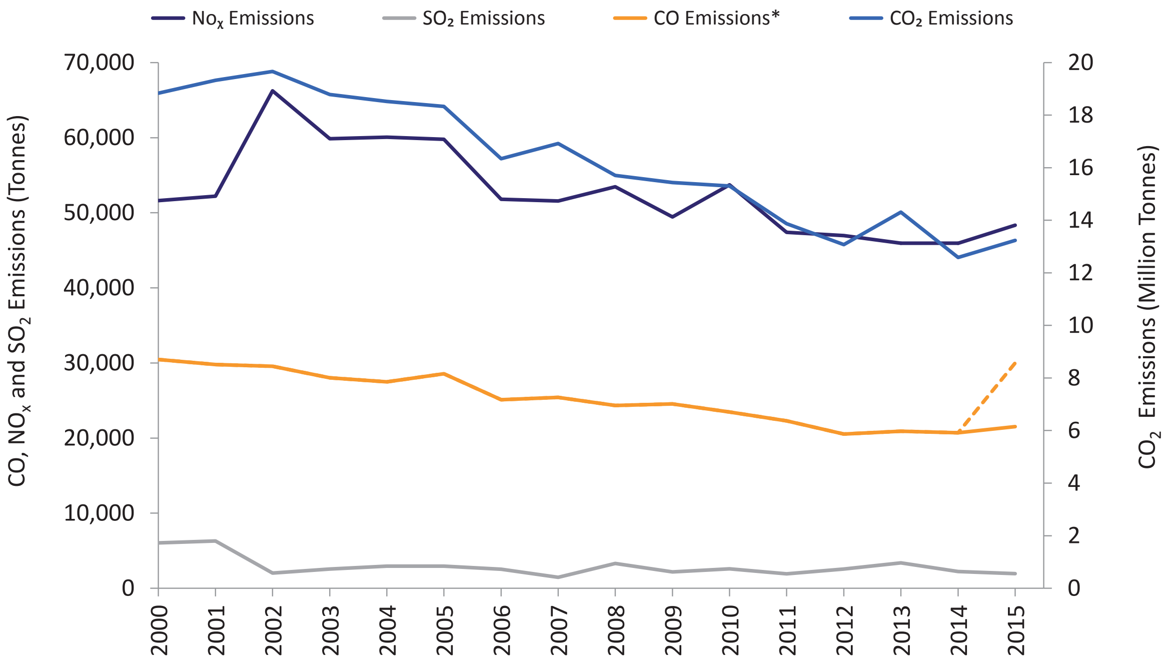
Seventy-five per cent of CO_2 emissions in 2015 were generated from fuel consumed by combustion equipment to provide electrical power and drive compressors for gas export. This activity is essential as offshore installations are not connected to the national grid for power supply. Power is required to run oil pumps, equipment used in production processes, for electricity and heat (cooking, lighting and heating on offshore installations), as well as for compression equipment so that gas can be transported ashore. CO_2 is also emitted during flaring and venting offshore, which are necessary for maintenance, well testing and, crucially, for the safety of offshore workers.

CO emissions have declined by 29 per cent since 2000. It is important to note that, as of 2015, the factor used to calculate CO values from fuel consumed has been amended in EEMS and the resulting value is shown as a dotted line in Figure 8. Therefore, the 2015 figure is not comparable with previous years and does not represent an actual increase in the mass of CO emitted in 2015.

NO_x emissions, on the other hand, follow a general downward trend but have been more variable over the timeframe. This could be due to the varying use of diesel for fuel when reservoir gas supply is unavailable such as during drilling activity, when new installations are being brought online, maintenance turnarounds, turbine ‘trips’ or disruption to the gas supply. Last year, just over 48,300 tonnes of NO_x were released offshore.

There is a trade-off between CO and NO_x emissions in turbines as they occur at different combustion temperatures, with CO emissions decreasing with rising temperatures and NO_x emissions increasing with rising temperatures.

Figure 8: Offshore Emissions of Carbon Dioxide[29], Nitrogen Oxides, Carbon Monoxide and Sulphur Dioxide



*The factor used to calculate CO values from fuel consumed was amended in EEMS in 2015; the resulting value is shown as a dotted line.

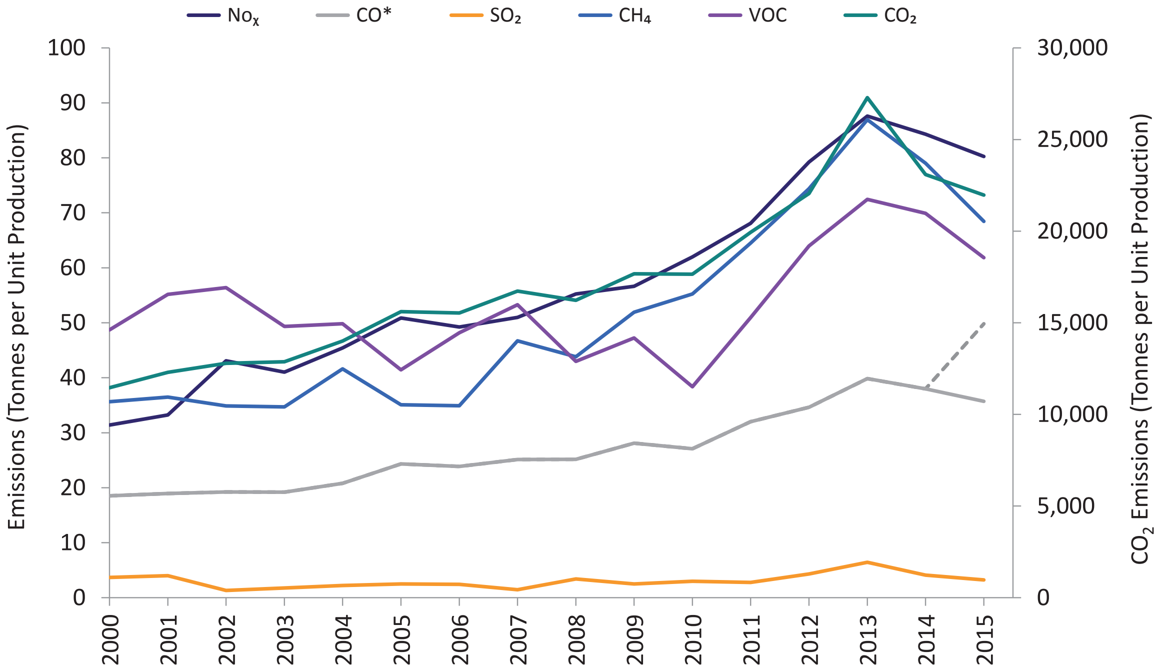
Source: EEMS July 2016

2015	CO_2	NO_x	CO	CO (old factor)	SO_2
Tonnes	13,232,726	48,334	30,004	21,518	1,955

[29] Fugitive emissions (leaks and other unintended or irregular releases from connections, valves, etc) and emissions from oil loading are also small sources of CO_2 emissions.

Figure 9 shows atmospheric emissions when normalised against production. As production has declined from 2000, the emissions per unit production have increased on the UKCS. However, since 2013, the emission intensity has begun to fall. This downward trend continues in 2015 even with an increase in production, resulting in a carbon emission intensity of 22,000 tonnes per million boe.

Figure 9: Offshore Atmospheric Emissions per Unit Production



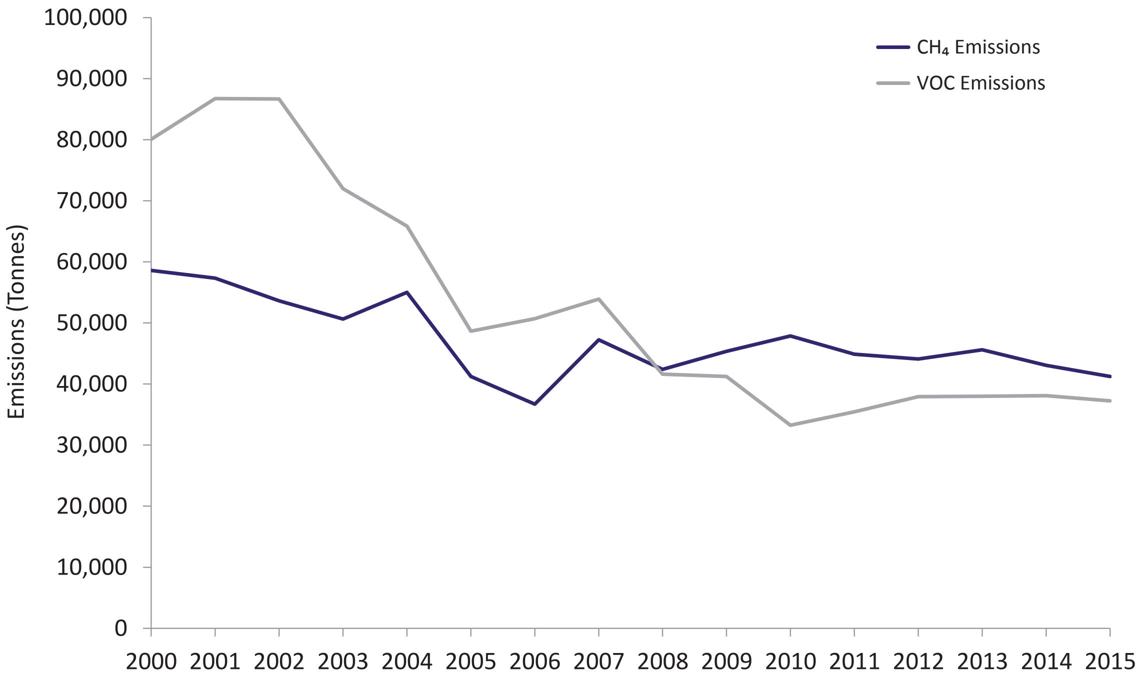
*The factor used to calculate CO values from fuel consumed was amended in EEMS in 2015; the resulting value is shown as a dotted line.

Source: EEMS July 2016, BEIS

Methane and Volatile Organic Compounds Emissions

Last year, 41,200 tonnes of CH_4 were emitted, a 30 per cent net reduction since 2000. In 2015, 37,200 tonnes of VOCs were emitted from offshore installations, a net reduction of over 53 per cent since 2000. Values for CH_4 and VOCs in 2015 are consistent with those emitted since 2012.

Figure 10: Offshore Emissions of Methane and Volatile Organic Compounds



Source: EEMS July 2016

CH_4 or natural gas is a potent GHG and so Oil & Gas UK has carried out further analysis to identify the offshore sources of CH_4 emissions, as well as VOCs.

Figure 11 shows that the largest sources of VOC emissions in 2015 were gas flaring and venting (66 per cent) and oil loading (28 per cent), while the majority of CH_4 emissions were generated from venting.

Figure 11: Offshore Emissions Sources of Methane and Volatile Organic Compounds in 2015

Emissions Source	CH_4	VOCs
Fuel consumption	7%	3%
Fugitives	4%	3%
Gas flaring	34%	38%
Gas venting	53%	28%
Oil loading	1%	28%

Total CH_4 fugitive emissions in the UK in 2014 came to 30.1 million tonnes CO_2e, which includes 4.3 million tonnes CO_2e associated with the exploration, production, transmission, upgrading and refining of crude oil and the distribution of crude oil products (this includes offshore production and onshore refining and distribution of hydrocarbon products)[30].

In 2015, the contribution of CH_4 emissions from offshore oil and gas exploration and production was 1.2 million tonnes CO_2e.

On the Norwegian Continental Shelf, 12,500 tonnes of CH_4 and 7,500 tonnes of VOCs[31] were emitted in 2014, which is significantly lower than previously reported. These emissions come partly from fugitive emissions and gas leaks and partly from operational emissions (cold venting). In 2015, in the UK, 23,717 tonnes of CH_4 and 11,465 tonnes of VOCs were emitted from gas venting and fugitive emissions. However, the level of uncertainty is considered to be high in the Norwegian data, and particularly the contribution from fugitive emissions. The 2014 Norwegian Environment Agency report proposes new methodologies for quantifying emissions and also identifies techniques and methods that enable emissions to be completely eliminated, however, it accepts that unless these are already in place it is unlikely to be economically viable for existing installations.

Gas Flaring

For offshore platforms flaring is an important safety feature to burn gas that cannot be recovered; to prevent over-pressurising; and to rapidly remove the gas inventory during an emergency. It is primarily carried out on oil-producing platforms. Flaring is likely to be planned for during start-up or shutdown of a platform, but also occurs during unplanned events. Flaring releases emissions that in general have lower global warming potential than those released by venting.

Gas flaring is subject to consent under the Petroleum Act 1998, which aims to conserve gas by avoiding unnecessary wastage during hydrocarbon production. Operators are expected to minimise flaring as far as possible. All flaring activity must be reported in EEMS, with consents for specific flare volumes over a limited timeframe granted by the Oil and Gas Authority (OGA)[32]. Applications undergo a detailed review and those installations that flare over 40 tonnes per day will have their consent reviewed annually.

As part of The World Bank's Global Gas Flaring Reduction Partnership[33], there is a proposal to revise gas flaring definitions to routine flaring, safety flaring and non-routine flaring. A new initiative under this partnership aims to eradicate routine flaring[34] by 2030, with endorsement from companies and governments globally. The UK is signed up through the EU and seven operators in the UK are also partners in the initiative.

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[30] The emissions are calculated by the EU Member States using the IPCC *Guidelines for National Greenhouse Gas Inventories of 2006*. See the *Annual EU Greenhouse Gas Inventory 1990–2014* and *Inventory Report 2016,* pages 316-329 at http://bit.ly/GGinventory16

[31] See http://bit.ly/cvfenorway

[32] See www.ogauthority.co.uk/licensing-consents/consents/flaring-and-venting

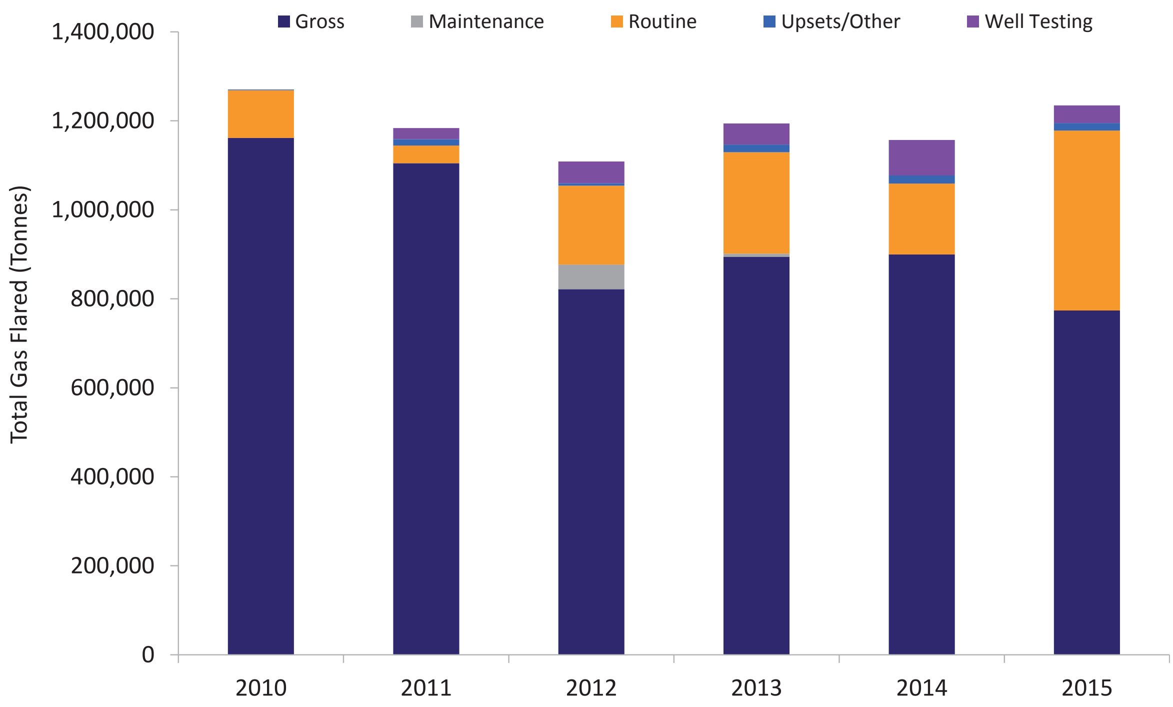
[33] See www.worldbank.org/en/programs/gasflaringreduction#1

[34] Routine flaring of gas at oil production facilities is flaring during normal oil production operations in the absence of sufficient facilities or amenable geology to re-inject the produced gas, use it on-site, or dispatch it to a market. See http://bit.ly/GGFR16

Just over 1.2 million tonnes of gas (about 3.5 million tonnes of CO_2e) were flared on the UKCS last year, a 7 per cent increase on 2014 due to the 10.4 per cent rise in production.

Flare gas is reported under EEMS as either routine, maintenance, process upsets, well testing or gross[35]. Gross is reported when a breakdown is not available and could therefore be any of the other categories; the majority falls into this category, as shown in Figure 12. When excluding gross, routine flaring accounts for the greatest proportion of emissions in each year.

Figure 12: Breakdown of Gas Flaring by Source



Source: EEMS July 2016

Analysis of the EEMS data indicates that the majority of flaring between 2010 and 2015 took place in the central North Sea (CNS) and northern North Sea (NNS) at 37 per cent and 53 per cent by mass, respectively. This is likely because of the greater proportion of larger and older oil-producing platforms in these regions that were designed to flare gas from the reservoir during production. Breaking this down further, the 52 installations on the UKCS that are aged between 31 to 40 years old flared over 36 per cent of the total gas between 2010 and 2015. Retrospective changes to these platforms' design would be very costly and are likely to render them uneconomic.

Installations brought on-stream in the last ten years in new regions such as the west of Shetland (W o S) have much lower levels of flaring, accounting for less than 14 per cent of the total, while the oldest gas platforms in the southern North Sea (SNS) accounted for just over 3 per cent of the total gas flared.

[35] See http://bit.ly/AGNgov

Gas Venting

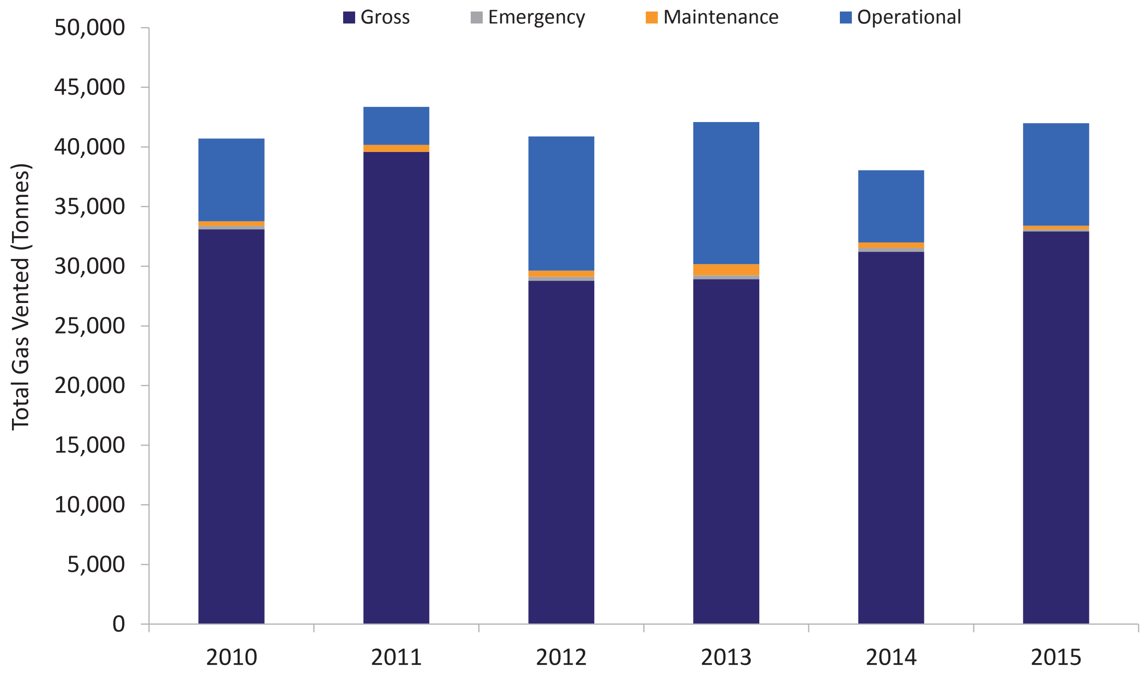
Gas venting releases natural gas associated with production directly into the atmosphere without ignition. Venting is a safety mechanism to release gas pressure when a safe level may be exceeded.

Venting is also subject to consent under the Petroleum Act 1998 through application to the OGA. Applications undergo a detailed review and those operators that vent over five tonnes per day will be reviewed annually. All venting activity must be reported in EEMS.

Almost 41,000 tonnes of gas were vented on the UKCS last year, a 10 per cent increase on 2014 in line with the percentage rise in production. Just under 558,000 tonnes of CO_2e were emitted from venting on the UKCS in 2015, which is approximately a sixth of that released through gas flaring.

Gas venting is reported under EEMS as either operation, maintenance, emergency or gross. Gross is reported when a breakdown is not available and could therefore be any of the other categories; the majority falls into this category, as shown in Figure 13. When excluding gross, operational (equivalent to routine for flaring) accounts for the greatest proportion of emissions in each year.

Figure 13: Breakdown of Gas Venting by Source



Source: EEMS July 2016

The largest proportion of gas vented between 2010 and 2015 was in the NNS (41 per cent). This is likely due to the presence of older and larger integrated platforms in this area. Gas venting is also associated with natural gas production and so the gas-producing SNS region has the second largest percentage of vented emissions (31 per cent).

Installations less than ten years old (12.5 per cent of reporting platforms) are the smallest contributors to gas venting on the UKCS (just over 2.5 per cent) between 2010 and 2015. This indicates that this activity is being minimised through design of these installations and, in turn, the new developments in the W o S mean this area vents smaller proportions of gas at 2.3 per cent.

Potential Environmental Impacts

Atmospheric emissions have several potential environmental impacts, such as stratospheric ozone depletion, ground level ozone formation, ocean acidification and increases in GHGs. The potential impact of ozone formation and acidification is mitigated by the geographical location of most offshore installations, which are a long way from the coastline and human populations.

The UK Government has made several commitments to reduce total UK atmospheric emissions through international agreements, such as the 2015 Paris Agreement and through domestic legislation such as the Climate Change Act[36] and the Fifth Carbon Budget[37]. The UK has also set targets of 15 per cent energy consumption from renewables by 2020[38].

However, the move to a lower carbon economy in the UK must be achieved in a responsible manner. Everyday life depends heavily on ready access to affordable and reliable energy from a secure domestic source, as well as a variety of oil-derived products such as textiles, medicines, cosmetics, electronic equipment, plastics, fertilisers and cleaning products. Most plausible estimates suggest that at least half of the world's energy needs will continue to be met by oil and gas for the foreseeable future.

Reducing GHG emissions is a global challenge that requires a global response and the UK Government's intention to ratify the Paris Agreement as a non-EU signatory is supported. A shared responsibility exists for all companies, governments and citizens to consider the carbon intensity of products and services that are produced and consumed. Consideration should also be given to life cycle emissions associated with products and services. Exploration, production and transport of hydrocarbons make up a small percentage of overall oil and gas life cycle emissions – approximately 9 per cent for oil and 16 per cent for gas[39].

The offshore oil and gas industry aims to reduce emissions from operations by taking part in emissions trading schemes and implementing energy efficiency improvements. The need to ensure equipment is maintained for safety and reliability reasons also means that high levels of energy efficiency are sustained.

Gas production from the UKCS is a critical element for the UK security of energy supply and its decarbonisation policy. Indigenous gas production permits greater deployment of renewables without incurring the economic risks associated with dependence on gas imports to back-up variable renewable output. In other words, maximising economic recovery of domestic gas from the UKCS will assist in delivering wider energy and climate policy objectives.

As the UK negotiates its exit from the EU, it is essential that the UK Government and the oil and gas industry work together to ensure that efforts continue to manage the environmental impact of the industry, balancing this with security of supply.

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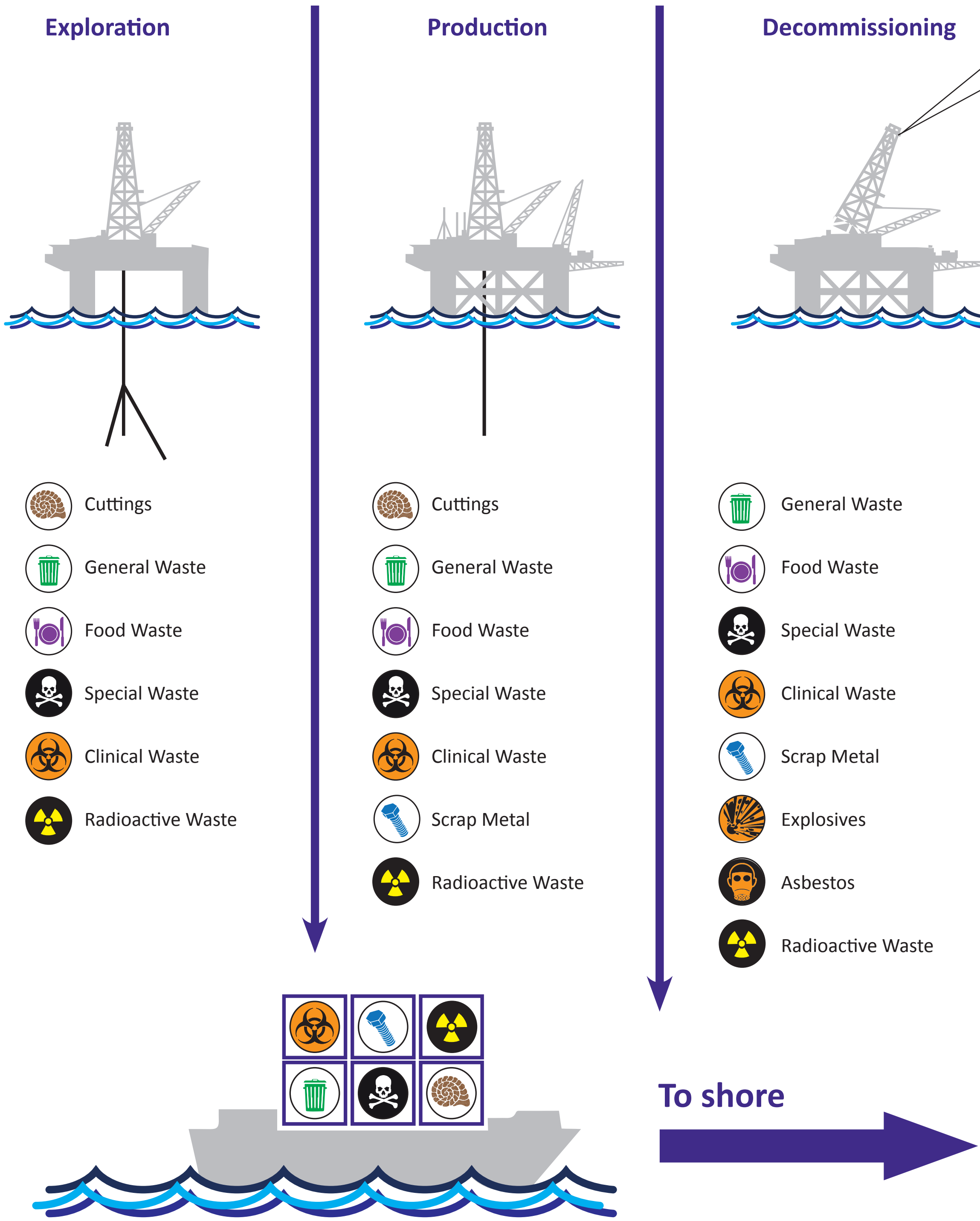
[36] See www.legislation.gov.uk/ukpga/2008/27/contents
[37] See http://bit.ly/CBTccc
[38] See http://bit.ly/RHT2020
[39] See http://bit.ly/GHGvNG. The data came from the US. UK data could not be sourced.

3.5 Waste

According to the EU Waste Framework Directive (2008/98/EC)[40], waste means “any substance or object that the holder discards or intends or is required to discard”. As with the creation of any product, oil and gas production generates and disposes of waste. As illustrated in Figure 14, waste originates at various points in the life cycle and can be found in different states – solid, liquid, hazardous and non-hazardous (inert) materials.

Figure 14: Waste Generated Offshore by Source



[40] See http://bit.ly/EUwfd08

Waste is segregated and stored appropriately on offshore installations before transportation to shore where it is landed at a port. It is then transferred to a licensed waste contractor who organises waste management. Disposal to landfill is costly and is not sustainable in the long term. Operators segregate wastes to reduce the quantity of material going to landfill and to maximise reuse and recycling.

The total amount, as well as the type, of waste generated varies from year to year depending on the level of industry activity in exploration, production, maintenance and decommissioning. Wastes classified as hazardous only present a risk to the environment if they are improperly managed. Modern disposal and recycling techniques, such as engineered landfill, incineration and recovery of waste oils, minimise the environmental impact.

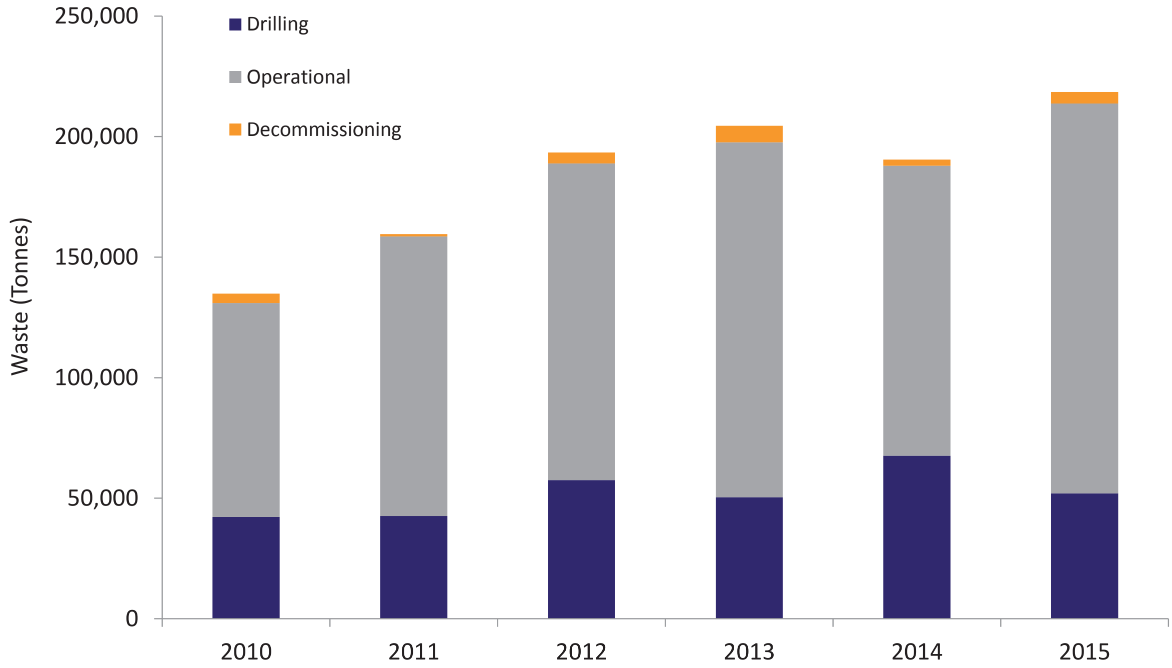
Waste Mass

In 2015, around 218,500 tonnes of waste materials were returned to shore from the UKCS. This represents a 15 per cent increase when compared to 2014 (190,000) and continues the general rising trend since the mid-2000s.

The increase in waste in 2015 is largely due to growing operational waste in the form of sludges, liquids and tank washings from mobile drilling rigs. This could be because of more rigorous reporting, but also well plugging and abandonment activity, which generates well fluids for disposal, and the growing number of rigs that are being stacked[41] and so need to be cleaned and their tanks emptied.

Meanwhile, the amount of drilling waste has fallen by 23 per cent to under 52,000 tonnes, corresponding to the decline in drilling activity. The rising decommissioning activity is reflected in an 86 per cent increase in decommissioning waste. Decommissioning waste is currently a small contributor to the overall figures at just 4,733 tonnes, but this is expected to increase in the coming years[42].

Figure 15: Waste Generated by Offshore Activity



Source: EEMS July 2016

[41] Reducing a crew on a rig to either zero or just a few key individuals and storing the rig in a harbour.
[42] See Oil & Gas UK's *Decommissioning Insight 2016* at www.oilandgasuk.co.uk/decommissioninginsight

Waste Composition and Disposal

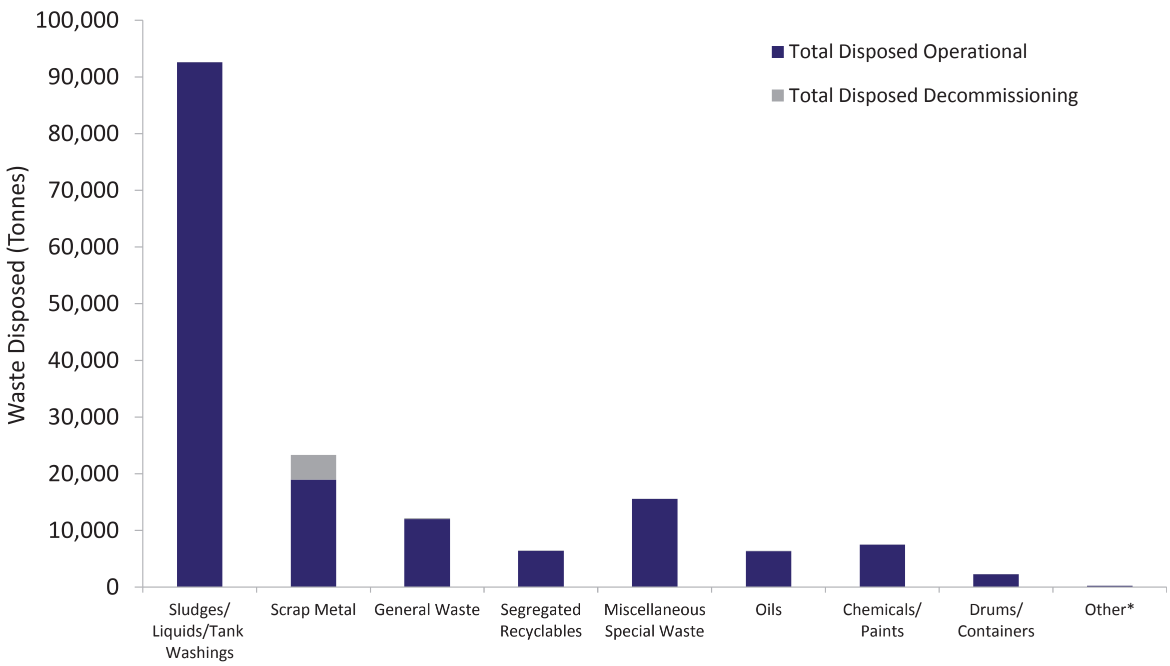
Last year, drill cuttings returned to shore were mainly made up of hazardous solids, hazardous oils and other hazardous liquids, such as oily water, with 11 per cent being non-hazardous. Solids and liquids are classified as hazardous if they contain small amounts of oil.

Sludges, liquids and tank washings make up over half of wastes from operational and decommissioning activities (56 per cent), with over 92,000 tonnes returned to shore last year. Liquid wastes are generally not separated from one another offshore due to physical space restrictions, giving rise to such a sizeable category.

Wastes are processed to separate hydrocarbons and heavy metals from solids and other liquids. The liquids are then treated for safe discharge to the sewer system, while the remaining materials can be used in renewable energy facilities such as anaerobic digesters[43]. Oil is recovered and usually reused as a fuel source and the cleaned solids are disposed of in a landfill.

The offshore industry generated over 4,300 tonnes of scrap metal from decommissioning in 2015, a significant increase on the 2014 figure of 1,900 tonnes, which was all reused or recycled. Over 95 per cent of the total decommissioning waste last year was reused or recycled.

Figure 16: Operational and Decommissioning Waste Generated Offshore by Category in 2015



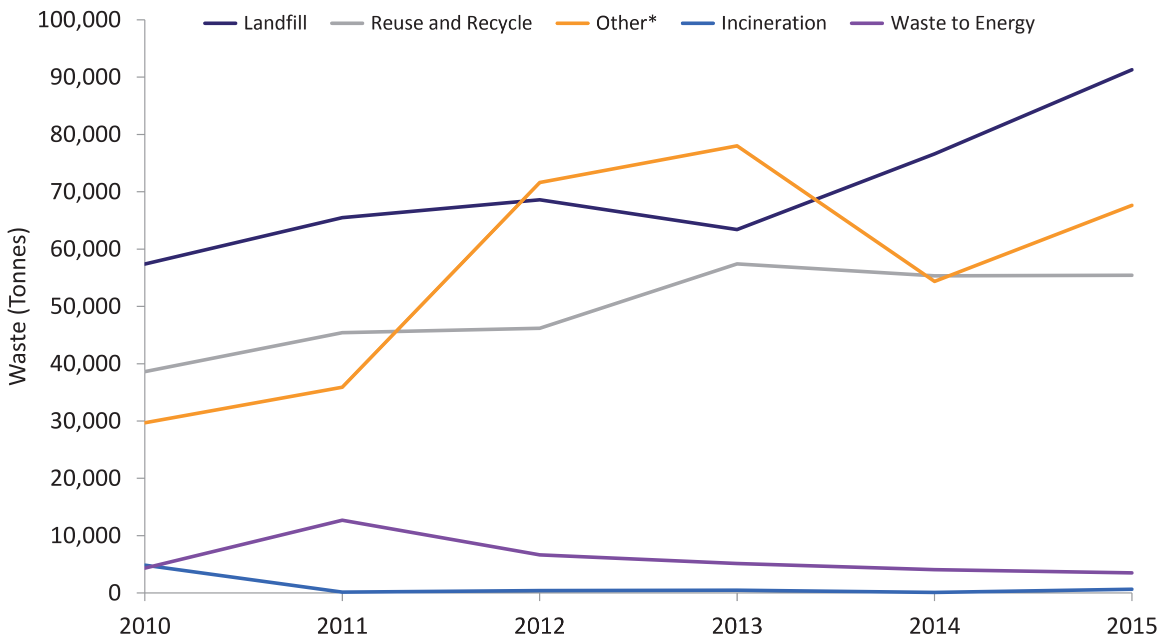
*Other includes wastes such as asbestos, clinical waste, construction materials, explosives and radioactive materials

Source: EEMS July 2016

Last year, 98 per cent of waste (216,500 tonnes) was brought to shore in the UK, with just 1 per cent transferred to the Netherlands for processing. The disposal route for 1 per cent of waste was categorised as "not applicable" or was not specified.

[43] Anaerobic digestion is the breakdown of biodegradable material by micro-organisms in the absence of oxygen.

Figure 17: Total[44] Waste Generated Offshore by Disposal Route



*Any other disposal route. This includes treatment of aqueous wastes, composting and land spreading

Source: EEMS July 2016

The amount of waste landed at each port and its subsequent disposal route is influenced by the waste generation location as well as the availability of waste contractors and disposal facilities near the port. Just over 192,500 tonnes (88 per cent) of the total waste returned to shore landed in the north east of Scotland at ports in Aberdeen and Peterhead. Of this, 81,000 tonnes (42 per cent) were sent to landfill for disposal, while 33 per cent (63,000 tonnes) was designated as "other" for disposal routes such as treatment of aqueous wastes, composting and land spreading. Almost 46,000 tonnes (24 per cent) were reused or recycled.

3.6 Fluorinated Gases

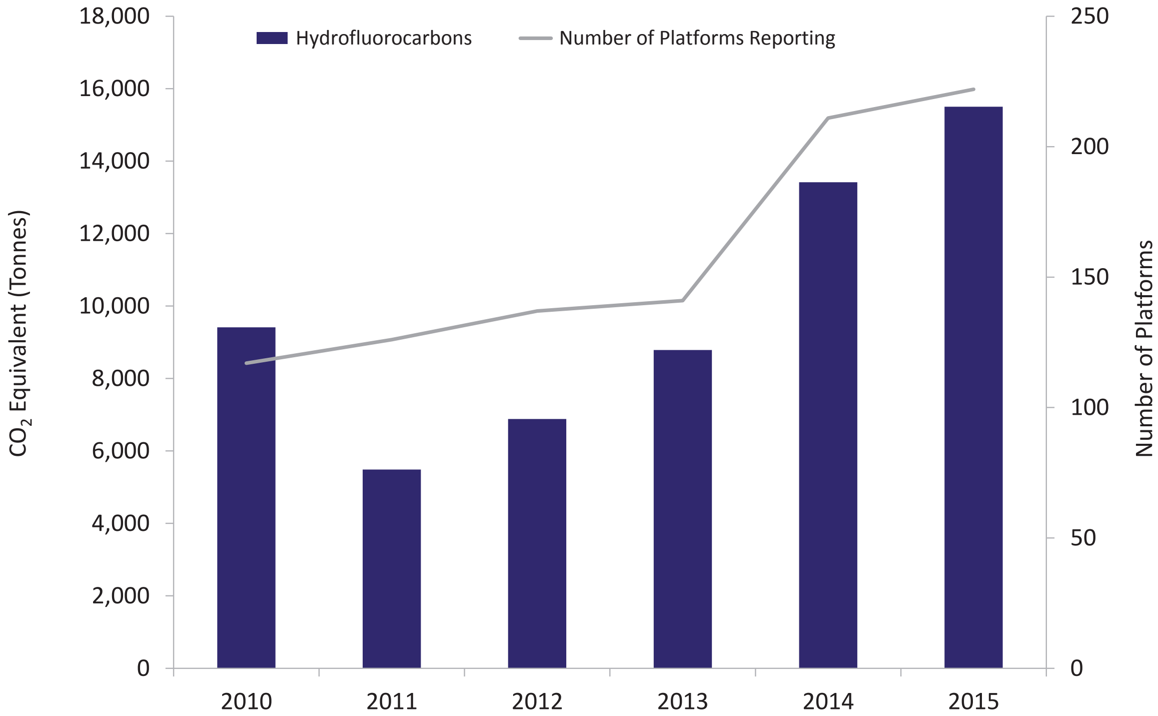
Fluorinated gases (F-gases) are used for industrial applications such as refrigeration, air conditioning and to a lesser extent fire protection systems and electrical switch gears. They are a known GHG and contribute towards global warming and, as such, their use is regulated under the 2014 EU Fluorinated Greenhouse Gas Regulation as part of the Kyoto Protocol[45]. The Regulation impacts anyone who manufactures, uses or services equipment that contains F-gases, like refrigeration, air conditioning systems, solvents or aerosols and is therefore applicable to the offshore oil and gas industry. Regulated F-gases include HFCs, PFCs and other perfluorinated compounds including SF_6.

Figure 18 overleaf shows that improved reporting from offshore installations led to an increase in the CO_2e emissions of HFCs between 2010 and 2015, with the number of platforms reporting each year rising from 117 in 2010 to 222 in 2015. This reflects the importance that industry places on managing the use of F-gases. Eliminating the use of chlorofluorocarbons (CFCs) due to their environmental impact may also have led to an increase in the use of HFCs as suitable replacements.

[44] Total waste includes drilling, operational and decommissioning wastes.
[45] See http://bit.ly/EUFgas14

F-gases are released from systems gradually over the year by seeping and so are not released in any large quantity at once. Their use is highly regulated and systems are required to be serviced by competent, certified persons. BEIS has implemented a new reporting limit of 250 tonnes per release, below which it is not necessary to report and this may have an impact on future data although it is expected to be minimal.

Figure 18: CO_2 Equivalent Emissions of F-Gases



Source: EEMS July 2016

In October this year, the Kigali Amendment to the Montreal Protocol set targets for HFC reduction that will come into force from 1 January 2019. The new agreement will set three separate pathways for different countries. Richer economies like the EU, the US and others will start to limit their use of HFCs within a few years and make a cut of at least 10 per cent from 2019. The impact on offshore emissions is still to be determined and Oil & Gas UK is working with members to understand the potential impact on the UKCS.

4. Environmental Performance Benchmarking

Each year Oil & Gas UK carries out a benchmarking exercise for operators reporting data into EEMS to gain an overview of their relative environmental performance in the context of the industry as a whole. The analysis is presented anonymously with each company allocated a letter in each category. The participating companies receive their individual results.

A selection of variables from the 2015 EEMS data are benchmarked in this analysis to identify trends. Areas of concerning or promising performance can be identified, with the aim of achieving greater industry-wide emissions efficiency as far as possible.

4.1 Methodology

Benchmarking was carried out by grouping EEMS variables by operator, ranking them and assigning a code for each individual graph. The result is a set of graphs where one operator may be ranked A, or first in one category, and Z, or 26th, in another. In this way a single operator's performance cannot be traced from one graph to another. Each individual operator will be informed of their rankings in each category, without the ability to attribute environmental performance to other companies.

Given the varied scale and types of operations on the UKCS, benchmarked rankings may not truly reflect some individual environmental performances, but allow a general understanding to be developed.

4.2 Oil in Produced Water

Produced water contains small quantities of naturally-occurring reservoir products. It is sampled on a daily basis offshore and the hydrocarbon content recorded in EEMS. OSPAR Recommendation 2001/1 requires individual installations to have annual average oil in water concentrations of less than 30 mg/l, while their monthly samples must contain less than 100 mg/l[46].

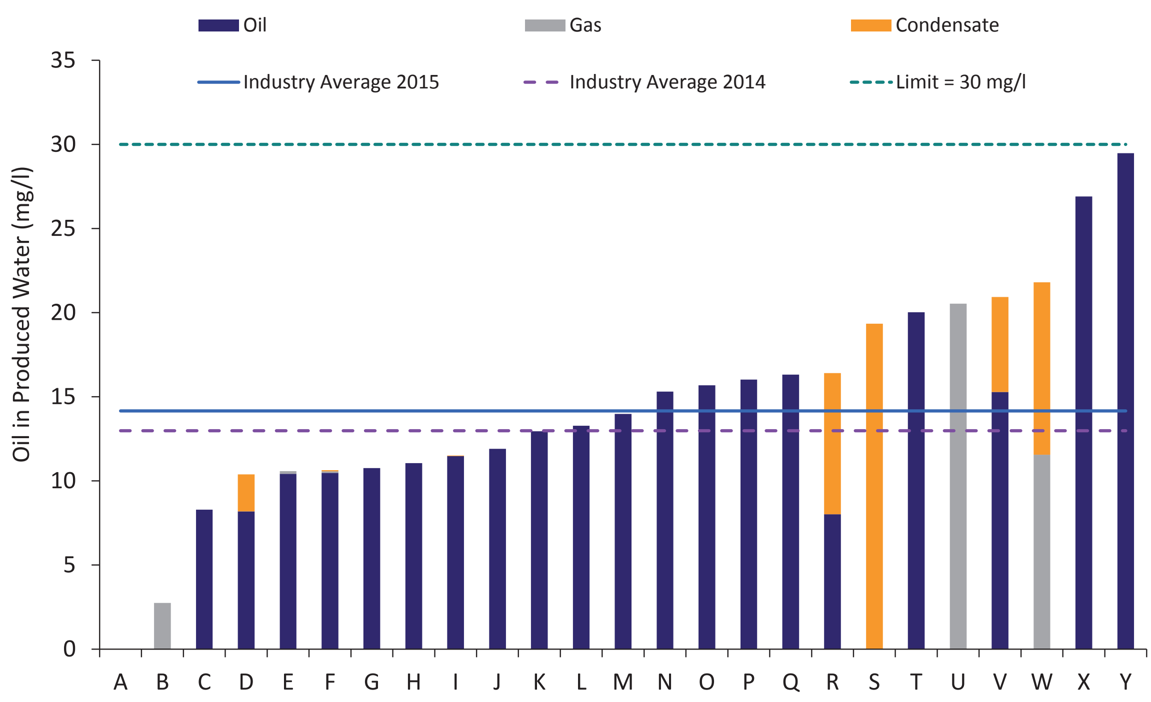
Average oil in water concentration is the result of several factors, which means that those operators with higher values may have more assets, greater production totals and may produce heavier hydrocarbons. This benchmarking, therefore, provides a general picture of industry oil in water performance, but cannot be interpreted as some operators performing better than others.

The mean oil in produced water concentration across the industry in 2015 was 14.2 mg/l, well below the OSPAR recommended limit of 30 mg/l, but higher than in 2014 due to increased production. See Figure 19 overleaf.

Thirteen of the operators had oil in water concentrations lower than this industry average. The average concentrations range from 0 to 29.48 mg/l for different operators.

[46] These limits are specified in *The Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 Guidance Notes*, available at http://bit.ly/1Qkdhz5

Figure 19: Concentration of Oil in Produced Water for each Operator by Hydrocarbon Type



Source: EEMS July 2016

4.3 Discharged Drill Cuttings

Figure 20 opposite shows the distribution of drill cuttings discharged to sea across the operators on the UKCS in 2015. The amount discharged depends on the length of wells drilled – the longer the well, the more drill cuttings produced. In 2015, almost 270 tonnes of cuttings were discharged per well drilled, which is slightly lower than in 2014 (280 tonnes per well drilled).

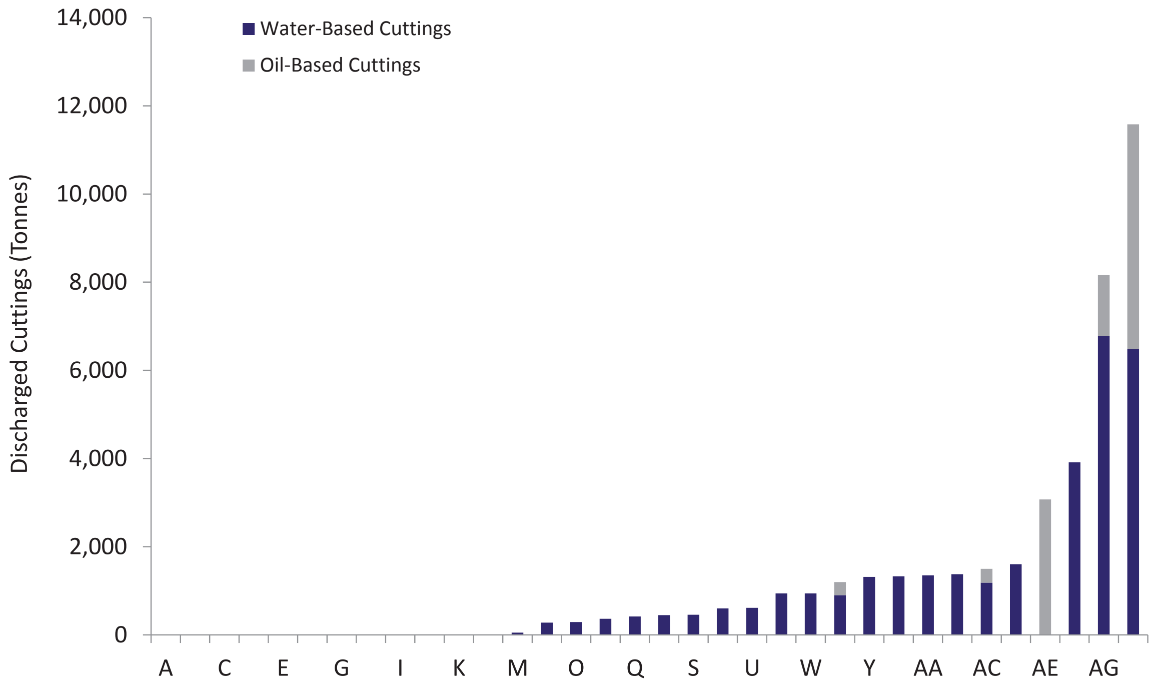
Last year, just five of the 33 operators in this category discharged treated oil-based fluid cuttings. Discharge of untreated oil-based fluid cuttings is not permitted on the UKCS and so all of these assets have on-board systems to clean any discharged cuttings to the permitted standard (less than 1 per cent oil content).

An increase from just under 9,000 tonnes of oil-based fluid cuttings discharged in 2014 to just over 10,000 tonnes in 2015 indicates that more on-board cleaning is being carried out, reducing pressure on onshore waste treatment and disposal options. Alternative routes for cuttings disposal include shipping to shore, injection and leaving in the well.

Operators A to L are those that either carried out no drilling in 2015, or shipped all their cuttings to shore for remediation and disposal.

Operators AG and AH carried out relatively large drilling campaigns in 2015 and, although the number of wells drilled equates to less than 15 per cent of the total, the majority of wells were significantly longer than the industry average, accounting for the high mass of drill cuttings.

Figure 20: Cuttings Discharged to Sea per Operator



Source: EEMS July 2016

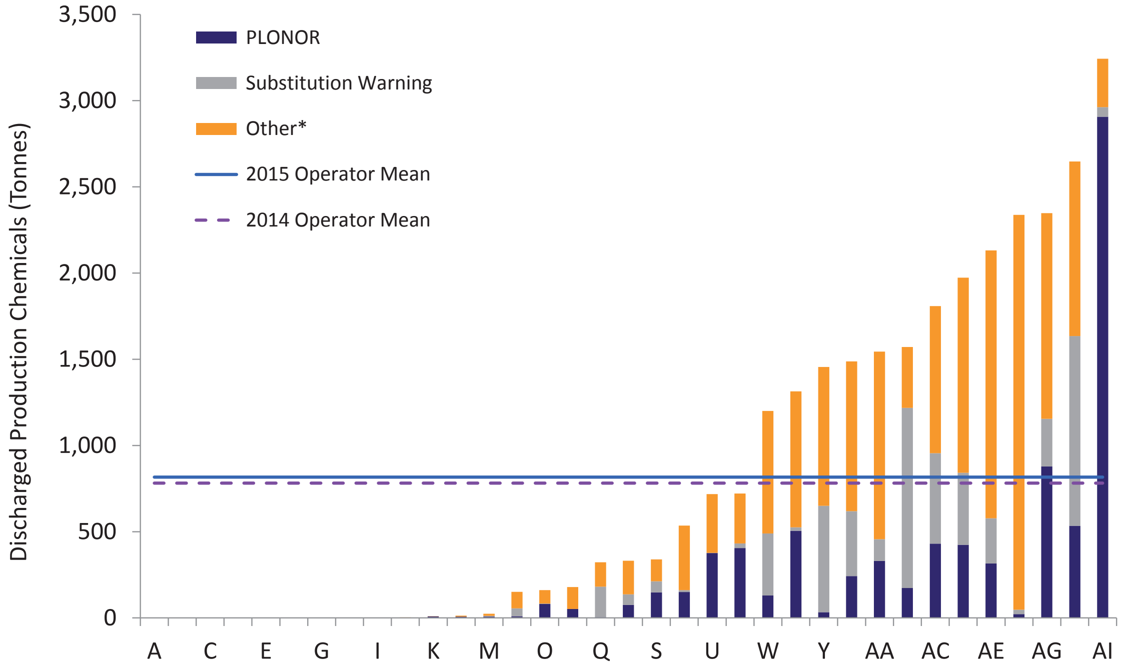
4.4 Production Chemicals

Last year, there were three main categories of production chemicals discharged to sea, as illustrated in Figure 21 overleaf. Twenty-two of the 35 reporting operators discharged less than the average of 816 tonnes per operator; eight reported between one and two thousand tonnes; and the remaining five reported larger amounts.

On a per operator basis, the mass of chemicals used ranges from 0 to 3,200 tonnes, but this does not directly correlate to production and so the operator that used the most chemicals is not necessarily the one that produces the most. This is due to the differing well conditions that dictate the amount of chemicals required.

From one tonne of production chemical, 2,875 tonnes of oil equivalent were produced in 2015. This is slightly higher than in 2014 when 2,797 tonnes were produced for each tonne of production chemical and reflects both improved performance from existing assets and new fields with more efficient technology coming on-stream.

Figure 21: Production Chemicals Discharged to Sea per Operator



*Other includes those chemicals reported in EEMS that are not classified as PLONOR or SUB but all chemicals have a permit to be discharged

Source: EEMS July 2016

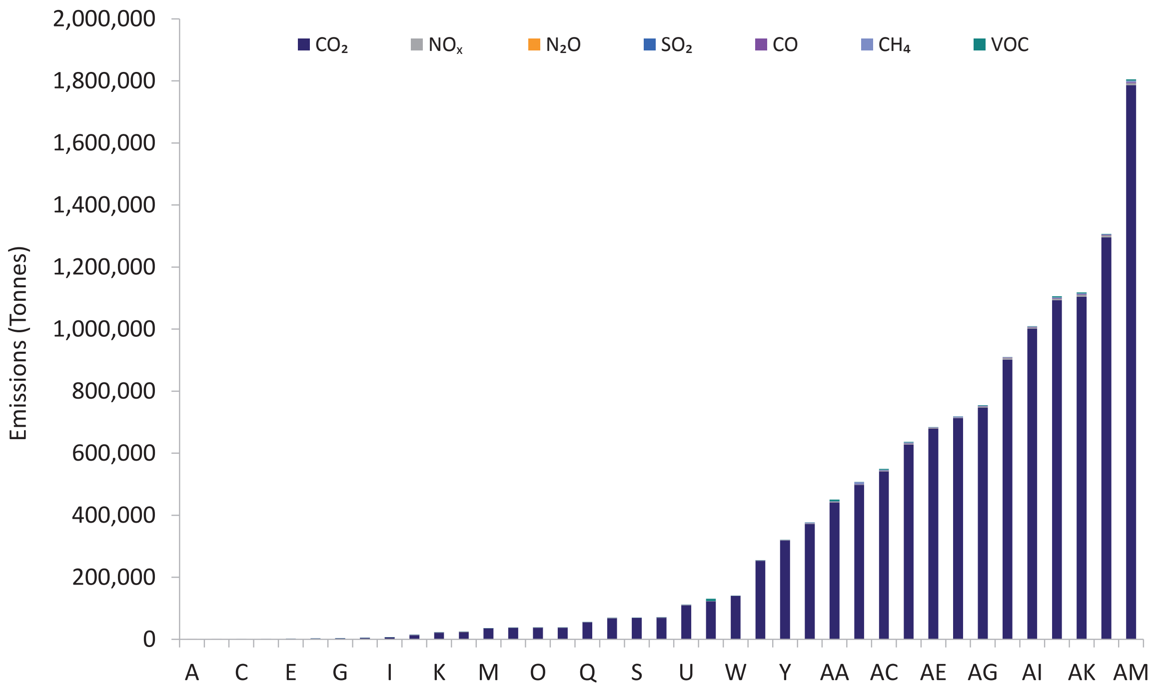
4.5 Total Offshore Atmospheric Emissions

Atmospheric emissions on the UKCS are permitted by BEIS and recorded in EEMS. The total atmospheric emissions for facilities across the UKCS for each operator are shown in Figure 22, broken down by type of emission. The overwhelming majority of emissions are CO_2 and so other emissions have been broken down in Figure 23, keeping the same relative position for each operator.

An average of just over 67,200 tonnes of total atmospheric emissions were produced per asset on the UKCS in 2015. This is approximately 6 per cent higher than the average of 63,500 tonnes in 2014. The emissions range from 164 tonnes to 1.8 million tonnes, reflecting the range of production on the UKCS.

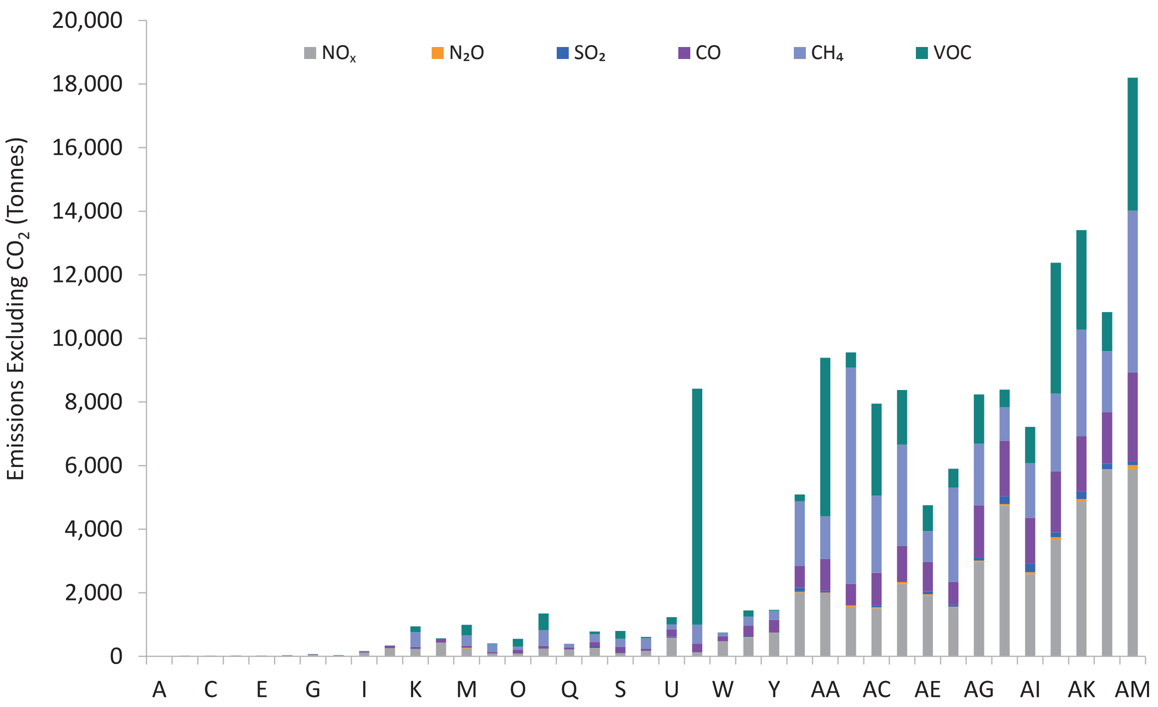
Although this benchmarking does not take into account the age, size and number of installations each operator has, in general, those with higher emissions are the larger operators with high production and predominantly oil platforms in the CNS and NNS regions. Those operators that appear to have zero emissions are non-operators and low production operators and the values are low enough to not be visible on the axis scale used.

Figure 22: Total Atmospheric Emissions per Operator by Emission Type



Source: EEMS July 2016

Figure 23: Total Atmospheric Emissions per Operator by Emission Type Excluding CO_2



Source: EEMS July 2016

5. Accidental Oil and Chemical Releases

The oil and gas industry does its utmost to prevent accidental oil and chemical releases by investing heavily in maintenance to prevent leaks; the provision of physical barriers such as downhole safety valves; and in the development of handling procedures and staff training.

Offshore hydrocarbon releases must be reported to the Health and Safety Executive (HSE) and all offshore hydrocarbon and chemical releases that reach the marine environment, regardless of size, must be reported to BEIS through the submission of a Petroleum Operations Notice 1 (PON1).

PON1 data are published on the BEIS website[47] and updated regularly. The following analysis is based on the PON1 dataset from 2003 to 2015 and presents an overview of the number and mass (excluding the mass of those releases still classified as 'under review') of accidental releases on the UKCS in 2015 and over the past decade.

Further analysis has been carried out to categorise PON1 data from 2010 to 2015 by source of accidental releases. Chemical releases have also been analysed by hazard to the marine environment.

Although the number of releases can appear significant, it is important to note that the UK offshore oil and gas industry is committed to transparency in reporting. All releases to the marine environment, no matter how small, are reportable as a PON1. Given that the releases are unplanned, they cannot always be measured and a worst case estimation is used to determine a release amount.

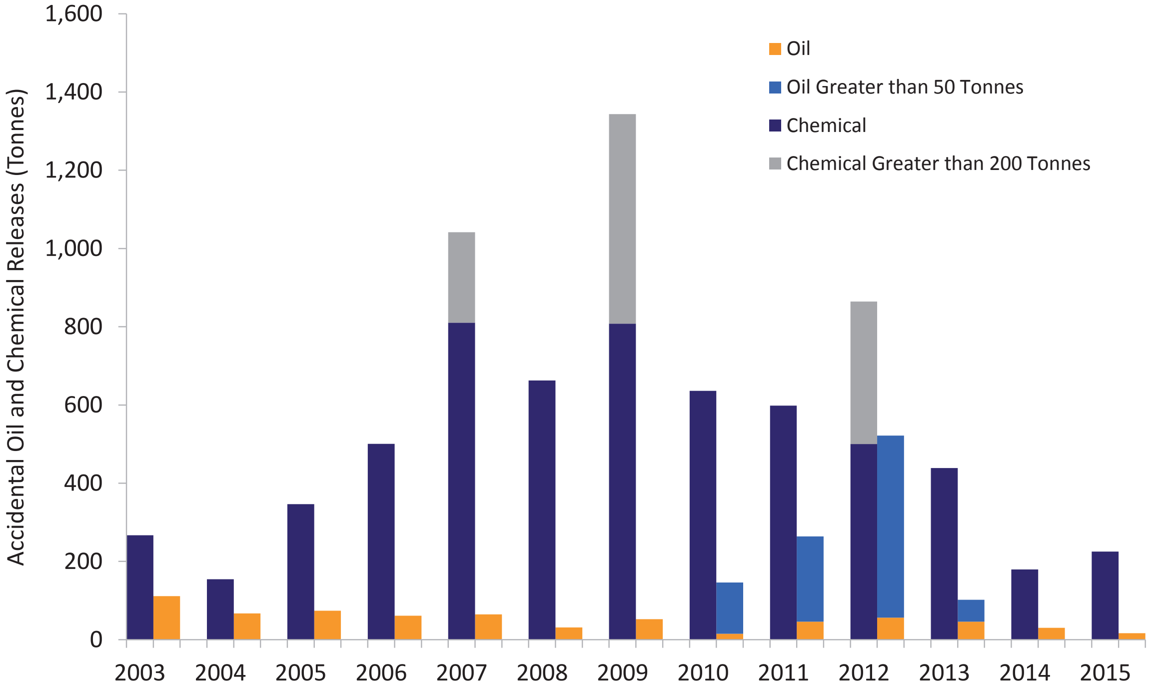
5.1 Overview from 2003 to 2015

There is no clear trend in the amount of chemicals and oil released to the marine environment over the last 13 years, highlighting the sensitivity of these data to single, low incidence, high mass events, as shown in the blue and grey peaks in Figure 24. There is, however, a marked decline in the amount released accidentally in recent years, with the mass of chemical releases falling sharply since 2009 and oil releases since 2012. 2015 saw the smallest mass of accidental oil released on record on the UKCS at 16.5 tonnes, with no individual releases greater than 2.2 tonnes.

The total amount of oil and chemicals accidentally released last year is also small relative to the total mass discharged to sea from assets under permits (see section 3). Many of the categories used to break down these data are dominated by a relatively small number of larger releases.

[47] The BEIS PON1 data are available at http://bit.ly/PON1data

Figure 24: Accidental Chemical and Oil Release Mass



Source: BEIS July 2016

5.2 Accidental Oil Releases in Context

In 2015, there were 243 accidental oil releases, from which 16.5 tonnes of oil were released to the marine environment. To put this into context, in the same year, approximately 2,300 tonnes of oil were discharged to sea in produced water, under permit, on the UKCS. This means that accidental oil releases represented 0.7 per cent of the total oil that entered the marine environment. Furthermore, 82 million tonnes[48] of oil equivalent were produced in 2015, meaning that accidental oil releases represented less than 0.00002 per cent of total oil production.

There were 66 fewer releases in 2015 than there were in 2014 and 21 fewer than 2013, with a 46 per cent reduction (from 30 tonnes to 16.5 tonnes) in the amount of oil accidentally released from 2014 to 2015. There has been a general decline in the average reported accidental oil release size from 2010 (0.56 tonnes) to 2015 (0.07 tonnes), with no releases greater than 2.2 tonnes last year. It should be noted, however, that seven releases remain under review and so do not have final masses assigned to them.

The IOGP[49], meanwhile, reports a worldwide total of 6,702 accidental oil releases in 2014, 74 per cent (4,979 incidents) of which were less than one boe. One boe is approximately equivalent to 0.14 tonnes of oil. In the UK, 235 of the 243 accidental oil releases last year (almost 97 per cent) were less than one boe.

There were 1,723 accidental releases greater than one boe in 2014 in the global IOGP dataset. Eight per cent (442 tonnes) were from offshore installations, resulting in 0.9 tonnes being accidentally released per million tonne of offshore production. In equivalent context, the UKCS reported approximately 0.23 tonnes accidentally released per million tonne of hydrocarbon production in 2014, and 0.18 tonnes in 2015.

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[48] The data come from the BEIS *Energy Trends Bulletin* at www.gov.uk/government/collections/energy-trends

[49] The International Association of Oil & Gas Producers (IOGP) *Environmental Performance Indicators* – Data are available to download at www.iogp.org/pubs/2014e.pdf. 2015 data were not available at the time of publication.

5.3 Accidental Oil Releases Breakdown

Releases by Oil Type

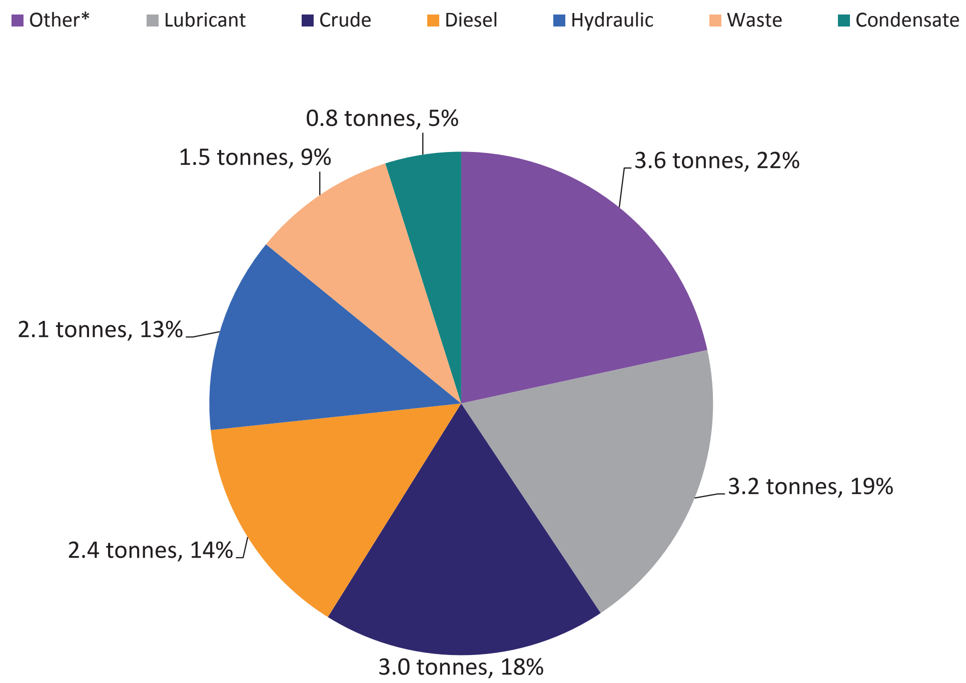
Determining the oil product type is an important element of an oil spill response, as it enables understanding of how the release will behave in the marine environment under varying conditions. Diesel and light oils will rapidly break up and evaporate when they are released. More persistent oil spills, such as crude oil, will be monitored and response operations take place as appropriate. Every offshore installation must have an oil pollution emergency plan (OPEP), approved by BEIS, setting out arrangements for responding to incidents to prevent pollution or to minimise its effect.

In 2015, lubricating oil and crude oil made up a significant proportion of the mass of oil accidentally released on the UKCS with 3.2 tonnes (19 per cent) and 3.0 tonnes (18 per cent), respectively. Other types that include kerosene, sludges and mineral oils contributed 22 per cent, while diesel and hydraulic oil contributed 2.4 tonnes (14 per cent) and 2.1 tonnes (13 per cent), showing that there is a relatively even split between the different types of oil release.

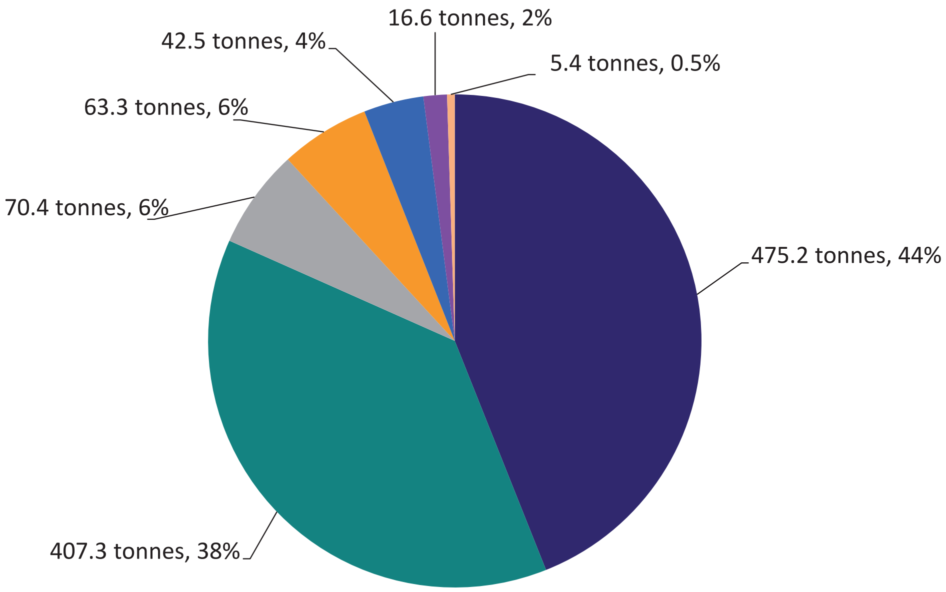
Over a longer timeframe, the most released product by mass between 2010 and 2015 was crude oil, with condensate also making up a significant proportion due to a single event in 2012. Diesel and lubricating oil contributed the most after these two groups.

Figure 25: Mass of Accidental Oil Releases by Product Type

2015



2010 to 2015



*Other includes small amounts of oils such as sludges, kerosene and mineral oils

Source: BEIS July 2016

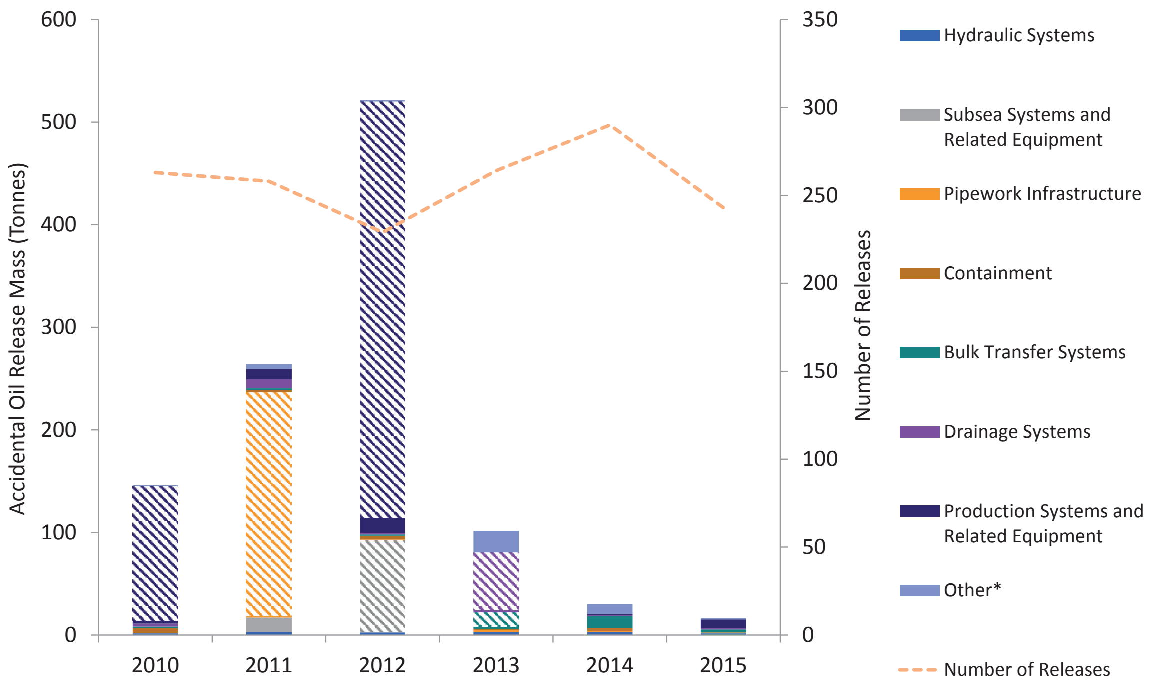
Releases by Source

Understanding source trends for past data allows operators to develop plans to target particular operational areas where accidental releases have been more frequent. There is annual variation in the breakdown of sources, reflecting the unplanned nature of the releases. There are limited data publically available on the circumstances leading to particular PON1 reports and so some categories are necessarily broad.

The majority (799 tonnes) of the reported accidental oil releases between 2010 and 2015 came from production systems and related equipment or pipework infrastructure. However, 754 tonnes (93 per cent) of this came from just three releases. In 2010, there was one spill of 131 tonnes of crude from a failed subsea sump pump; in 2011, 218 tonnes of crude were released from a pipeline; and, in 2012, 405 tonnes of condensate were released from a wellbore loss of containment. These masses are the worst case estimations for each incident and so the actual amount released is likely to be less. Another notable release was that of 56 tonnes in 2013 from a lubricating oil drain being incorrectly routed to sea.

As previously stated, the majority of releases are very small and so major releases have been shaded in Figure 26 to be easily identified. The graph shows clearly the significant impact on total mass that these individual incidents have.

Figure 26: Accidental Oil Release Mass by Source

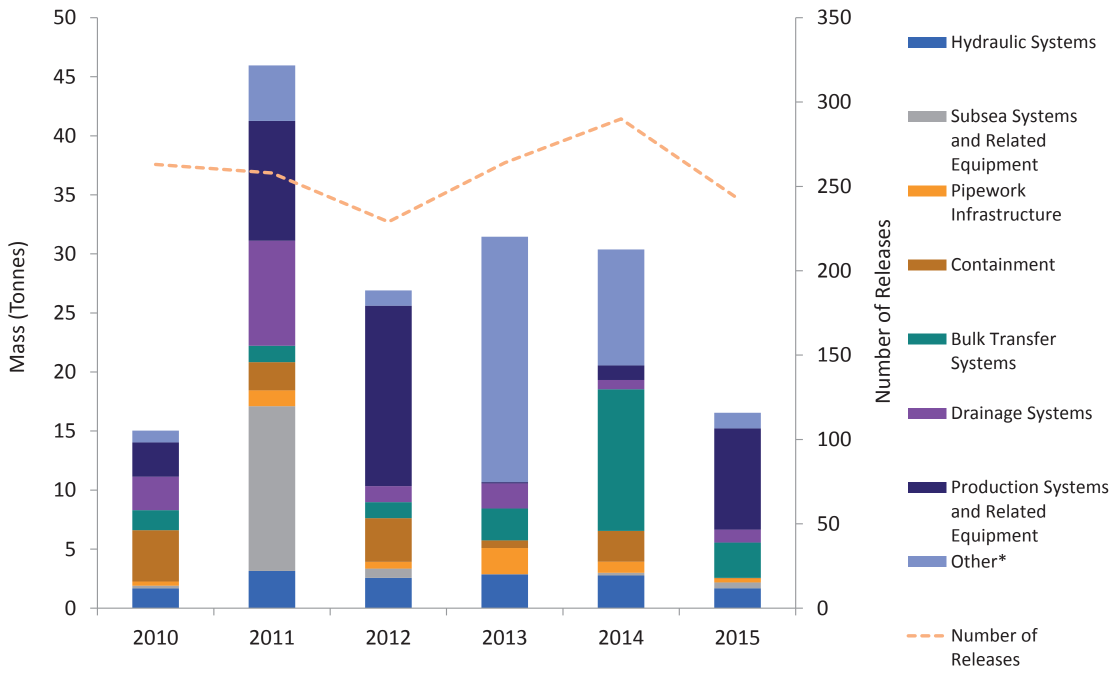


*Other includes releases from firefighting systems, flare systems, deck washings and unidentified sheen, as well as those releases for which no source is identified.
Shading highlights single large spills in that particular category

Source: BEIS July 2016

Figure 27 shows the sources of the releases over the last six years when the single large events have been removed. There has been a 36 per cent reduction in the mass of accidental oil releases from 2011 to 2015. With the exception of "other", production systems and bulk transfer systems are shown to have contributed the majority of accidental spills over the six years. However, beyond this there is little trend, which reflects the unplanned nature of such releases.

Figure 27: Accidental Oil Release Mass by Source excluding Outliers

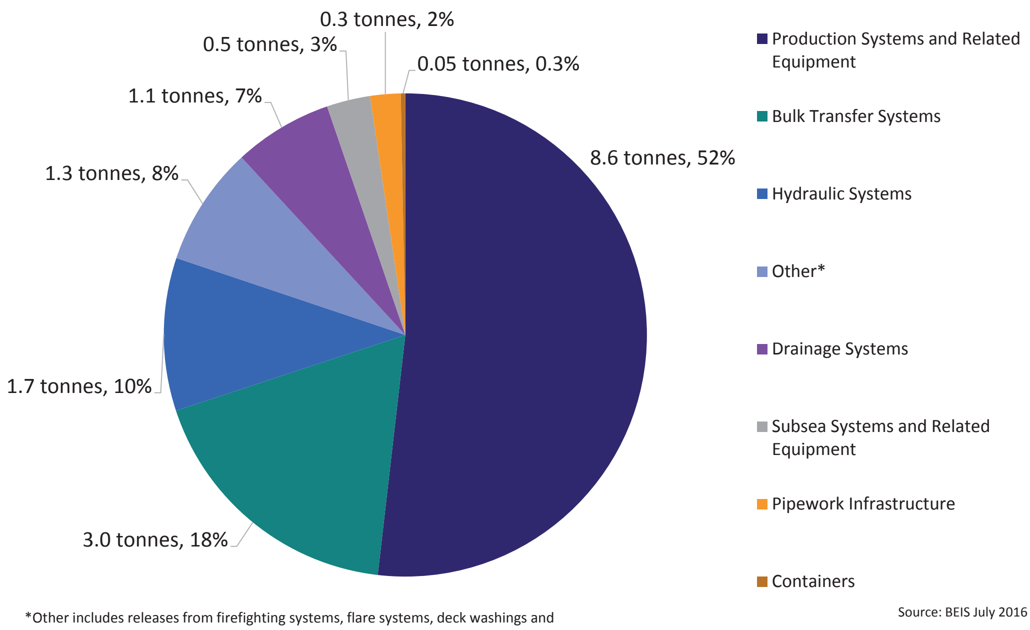


*Other includes releases from firefighting systems, flare systems, deck washings and unidentified sheen, as well as those releases for which no source is identified

Source: BEIS July 2016

Figure 28 shows a more detailed breakdown of release source for 2015. This shows that the largest contributor, as in previous years, is production systems and related equipment. There are 58 releases from 20 operators that fall into this category, averaging 0.15 tonnes. Four of these came from mobile platforms with the remainder from fixed ones.

Figure 28: Accidental Oil Release Mass by Source in 2015



*Other includes releases from firefighting systems, flare systems, deck washings and unidentified sheen, as well as those releases for which no source is identified

Source: BEIS July 2016

5.4 Accidental Chemical Releases in Context

In 2015, just over 225 tonnes of chemicals were accidentally released in 167 incidents on the UKCS. This was an increase of just over 25 per cent in the mass of chemicals released since 2014, but from 19 fewer reported incidents. Just over 100 tonnes can be attributed to three incidents and, therefore, it is these that account for the increase.

In 2015, approximately 372,800 tonnes of chemicals were used on the UKCS. Accidental releases therefore accounted for 0.06 per cent of the total mass of chemicals used. There was a slight increase in the average reported accidental chemical release size from 2014 (0.96 tonnes) to 2015 (1.35 tonnes). However, this remains much lower than in 2010 when the average release was 3.93 tonnes.

5.5 Accidental Chemical Releases Breakdown

Releases by Chemical Hazard Category

The chemical PON1 data have been assigned hazard categories to gain greater understanding of any potential impact on the marine environment. The CEFAS OCNS data[50] were used to produce the classifications detailed below. More detail is given in the appendix.

Figure 29: Hazard Ranking Categories for the Breakdown of Accidental Chemical Releases

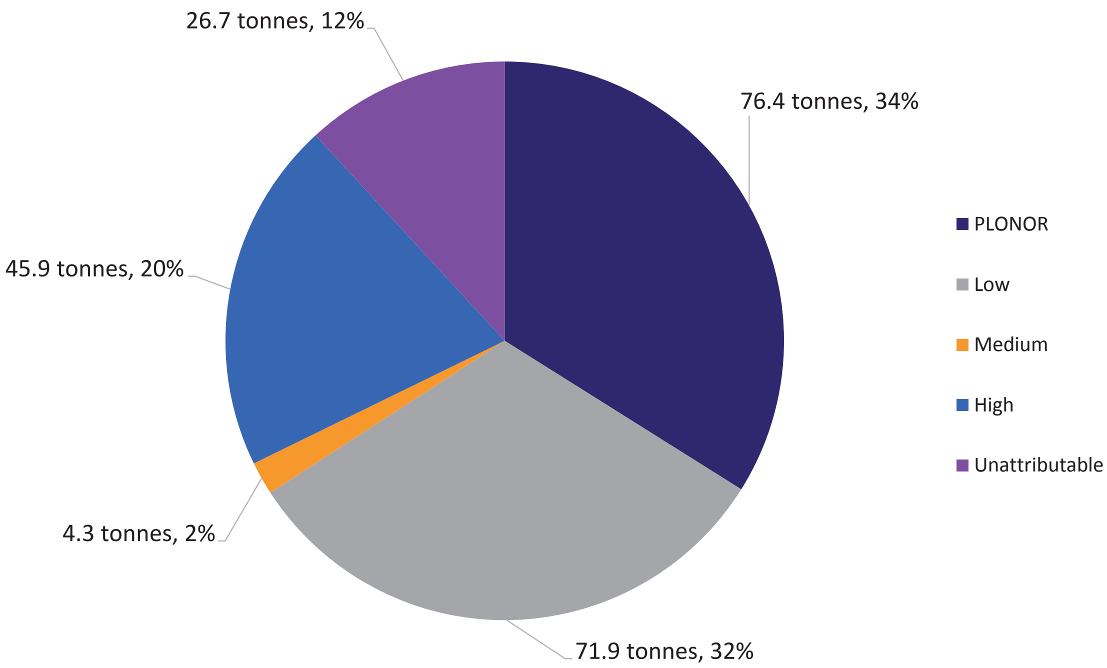
Hazard Ranking	Components
PLONOR	The PLONOR category includes all those products for which PON1s were submitted that have been assigned PLONOR (Pose Little Or NO Risk) status by BEIS.
Low	The Low Hazard category includes OCNS groups D and E, gold and silver as the lowest ecotoxicity groupings. This excludes products that have official PLONOR rankings.
Medium	The Medium Hazard category includes OCNS groups B and C as medium ecotoxicity groupings.
High	The High Hazard category includes OCNS group A, as the highest ecotoxicity grouping.
Unattributable	The remaining category includes all of those products for which sufficient description is not given and therefore they cannot be categorised in this model.

In 2015, 66 per cent (just over 148 tonnes) of all accidental chemical releases on the UKCS fell into the low and PLONOR hazard categories. Seven incidents and 20 per cent (45.9 tonnes) of the mass released fell into the high hazard category. This demonstrates that high hazard accidental releases were less common than low hazard and PLONOR releases, and tended to be larger, singular events last year. Chemicals in this category are predominantly composed of water with small amounts of high hazard chemical and therefore dissipate rapidly in the marine environment.

[50] The Centre for Environment, Fisheries and Aquaculture (CEFAS) Offshore Chemical Notification Scheme (OCNS) chemical classifications are available at http://bit.ly/CHARM16

The mass of high hazard chemicals accidentally released in 2015 (45.9 tonnes) remains relatively consistent with 2014 when 40.2 tonnes were released. 45.3 tonnes of the high hazard chemicals released last year came from a single incident when a hydraulic fluid was released after failure of a subsea control module. This is a water-based hydraulic fluid that holds a SUB warning and is currently being phased out of use on the UKCS. It is important to note that this product is largely composed (94 per cent) of PLONOR substances, but includes 0.8 per cent OCNS category A substance, which gives it its high hazard category status. This equates to 0.36 tonnes of category A chemicals being released.

Figure 30: Total Mass of Chemical PON1s Reported in 2015 by Hazard Category

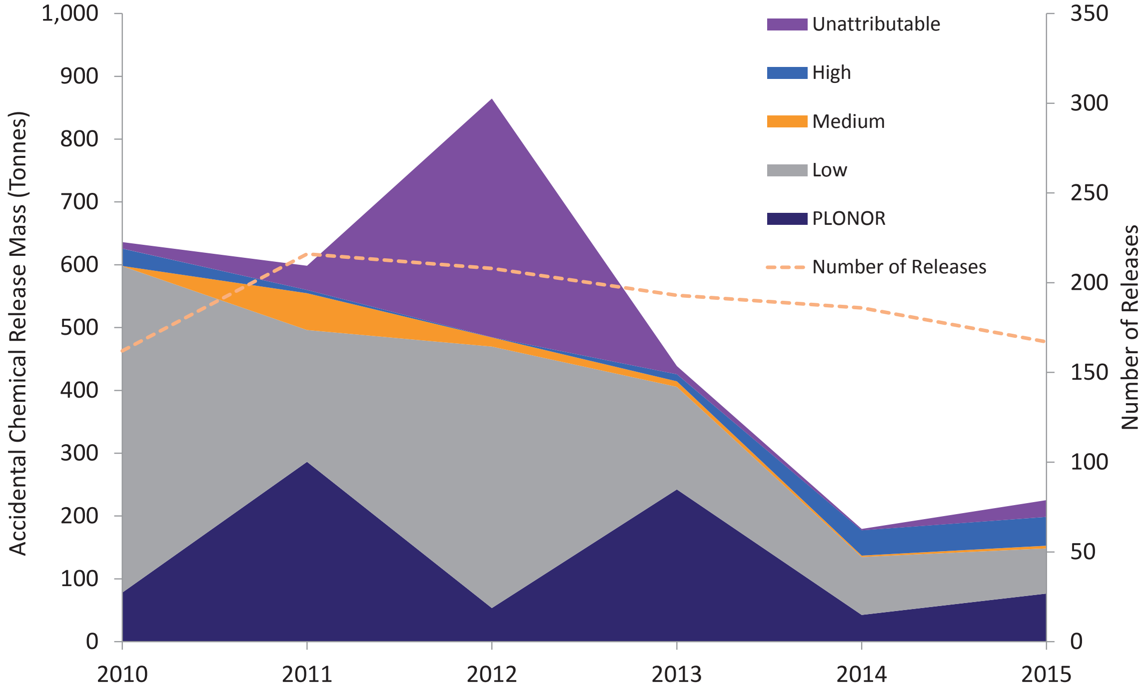


Source: BEIS July 2016

From 2010 to 2015, 2,942 tonnes of chemicals were reported in PON1s on the UKCS, representing a total of 1,132 incidents. PLONOR and low hazard category chemicals make up the majority (almost 2,252 tonnes, 77 per cent) of the mass released and the number of incidents. High and medium hazard category chemicals contributed 4.4 per cent and 3 per cent, respectively by mass, with the remaining falling into the unattributable category. The peak in unattributable releases in 2012, shown in Figure 31, is due to a single incident releasing a mixture of drilling fluids and therefore a single hazard category cannot be assigned at present

There has been a 65 per cent (more than 400 tonnes) decrease in the mass of chemicals accidentally released between 2010 and 2015. The number of incidents has remained relatively stable (increasing from 162 to 167). This shows that the releases are generally of smaller amounts than in previous years.

Figure 31: Mass of Accidental Chemical Releases by Hazard Category and with Number of Releases



Source: BEIS July 2016

Releases by Source

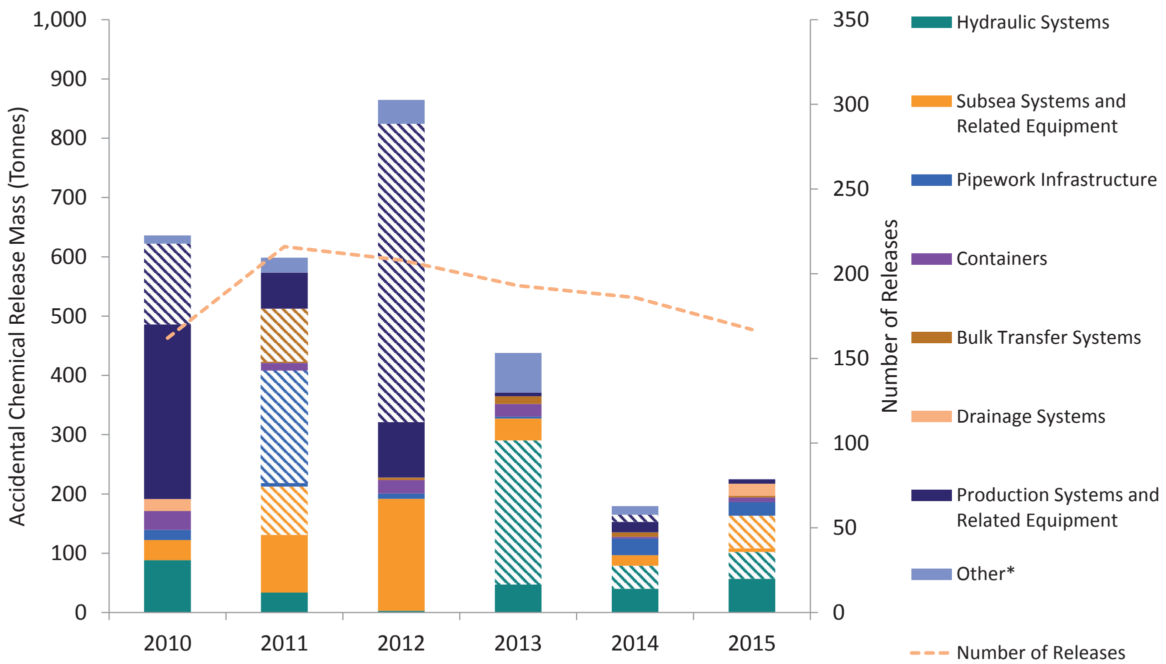
The accidental chemical releases from 2010 to 2015 are also categorised by source. Figure 32 opposite shows annual variation in the same way as the oil releases, highlighting the anomalous, largest incidents over the last five years and reflecting the unplanned nature of releases. The unknown category encompasses the accidental releases for which no source information was given. Consequently, it is expected that these figures may change in the future as further information becomes available from BEIS.

Between 2010 and 2015, production systems and related equipment contributed the majority (1,132 tonnes, 454 releases) of all accidental chemical releases, with hydraulic and subsea systems accounting for 596 tonnes (278 releases) and 517 tonnes (205 releases), respectively. Together, these three categories account for over 76 per cent of accidental releases by mass over the past six years.

The 2010 production systems and related equipment proportion (73 per cent of the total mass) is notable as it was dominated by eight releases of more than ten tonnes each. The largest of these was a release of 136 tonnes of a low hazard production control fluid due to the failure of a seal on a subsea template valve. This is the worst case release amount and contributes to the relatively large (26 per cent) contribution of seal failure to the causes of incidents in 2010.

Other notable releases were in 2012 when 364 tonnes of oil-based fluid were released following a wellbore loss of containment and, in a separate incident, 139 tonnes of water-based fluid were released from a wellbore. In 2013, there were two large releases from hydraulic systems, one of 54 tonnes of a low hazard hydraulic fluid and one of 189 tonnes of monoethylene glycol, which is designated PLONOR. These masses are the worst case estimations for each incident and so the actual amount released is likely to be less. The graph also shows clearly the significant impact on total mass for each year that the individual large events have.

Figure 32: Accidental Chemical Release Mass by Source

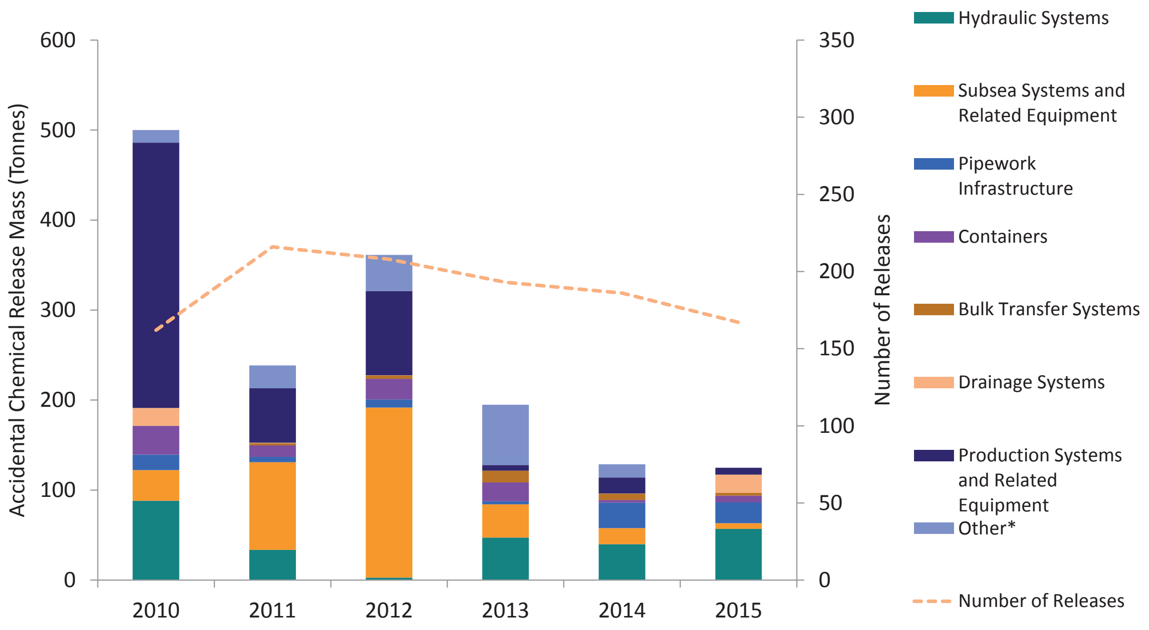


*Other includes releases from flare systems, deck washings, fire fighting and those releases for which no source is identified. Shading highlights single large spills in that particular category

Source: BEIS July 2016

Figure 33 shows the sources of releases from the last six years with the single large events removed. A general reduction in the mass of accidental chemical releases can be seen since 2010. Production systems, subsea systems and hydraulic systems have contributed the majority over the six years. However, beyond this there is little trend, which demonstrates the unplanned nature of such releases.

Figure 33: Accidental Chemical Release Mass by Source excluding Outliers



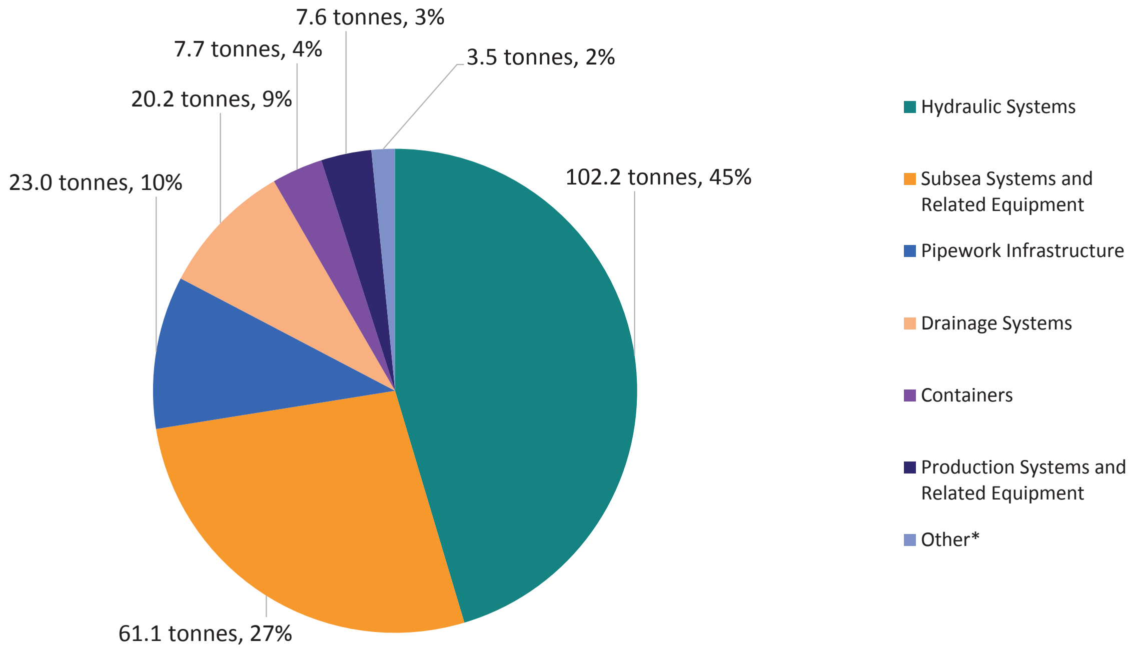
*Other includes releases from flare systems, deck washings, fire fighting and those releases for which no source is identified

Source: BEIS July 2016

Figure 34 opposite provides a more detailed breakdown of release source for 2015. This reveals a slight variation from the six-year trend with subsea and hydraulic systems being the main contributors while production systems were responsible for relatively little of the mass accidentally spilled. It is notable, however, that production systems had the highest number of releases with 87 falling in this category.

Eighteen operators contributed to the 50 hydraulic releases and 13 to the 44 subsea releases. The data, however, are distorted by the three large releases, two of which contribute 55 tonnes to the subsea category and one release contributes 45.3 tonnes to the hydraulic systems category. A subsea release of 30 tonnes was monoethylene glycol from a subsea pipeline joint and the other was 25 tonnes of various chemicals from a subsea well. The hydraulic release was hydraulic fluid from the failure of a subsea control module. If these large releases are excluded, then hydraulic systems remain the largest contributor and subsea becomes far less prominent. Pipework infrastructure and drainage systems are then the next two largest categories.

Figure 34: Accidental Chemical Release Mass by Source in 2015



*Other includes releases from firefighting systems, flare systems, deck washings and unidentified sheen, as well as those releases for which no source is identified.

Source: BEIS July 2016

The UK offshore oil and gas industry endeavours to reduce the number of oil and chemical releases on the UKCS. Through Oil & Gas UK forums and work groups members are encouraged to share experience from incidents and lessons learnt. This year, there has been particular focus on enabling future data gathering to better understand the sources and causes of hydrocarbon and chemical releases.

6. Significant Issues and Activities

The Health, Safety and Environment Team at Oil & Gas UK helps members manage the regulatory pressures emerging from governments that affect the licence to operate. We monitor and risk assess relevant legislation, identifying potential areas of concern for our members and stakeholders. We also look to influence the development of legislation where appropriate and maintain key stakeholder interfaces, allowing us to play an active role in policy formation across government and regulators. We also work with members and other stakeholders to generate several supporting tools and guidelines. Working in a collaborative manner has the twin benefits of reducing the overall cost of the work and allowing for wider industry and stakeholder input and review of the project outcomes. This section outlines key areas of focus in 2016.

6.1 Developing Tools Collaboratively

Technical Note on Financial Responsibility for Production Assets

On 19 July 2015, the EU Offshore Safety Directive (2013/30/EU) became UK law[51], representing the single biggest change to domestic offshore health, safety and environmental management in many years. Responding to the Deepwater Horizon incident in the Gulf of Mexico in April 2010, the European Commission sought to align the different major accident hazard regulatory frameworks across Europe with one rigorous regime aimed at further minimising the risks of offshore operations.

In the UK, the majority of the Directive's requirements were introduced through the Offshore Installation (Offshore Safety Directive) (Safety Case etc.) Regulations 2015[52], the Offshore Petroleum Licensing (Offshore Safety Directive) Regulations 2015[53] and the Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation Convention) (Amendment) Regulations 2015[54].

As part of the implementation of the Offshore Safety Directive (2013/30/EU), the Offshore Petroleum Licensing (Offshore Safety Directive) Regulations 2015[55] make provision relating to such licences in offshore waters. These regulations require the licensing authority to consider certain matters before granting such a licence and require the licensee to have and maintain adequate provision to cover liabilities and financial obligations for potential accidental events. The Competent Authority overseeing compliance with the Directive, or the Licensing Authority, may request evidence of this provision.

An Oil & Gas UK technical note, issued to operators by BEIS, outlines a pragmatic, flexible and cost-effective process for operators to satisfy the requirements of the Licensing Regulations 2015. The proposals outlined in the document have been agreed with BEIS and a supporting study to validate cost estimates for oil spill clean-up, fisheries compensation and management of waste is being carried out. This will update the cost study results carried out post the Deepwater Horizon incident and draws on new fisheries and hydrographic data for the North Sea.

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[51] Since the UK voted to leave the EU, Oil & Gas UK is working with its members to make this transition as smooth as possible and to maintain our world-class and robust safety regime on the UKCS.

[52] See www.legislation.gov.uk/uksi/2015/398/pdfs/uksi_20150398_en.pdf

[53] See www.hse.gov.uk/offshore/assets/pdfs/offshore-petroleum-licensing.pdf

[54] See www.hse.gov.uk/offshore/assets/pdfs/merchant-shipping.pdf

[55] See www.legislation.gov.uk/uksi/2015/385/made

Industrial Emissions Directive

The European Industrial Emissions Directive (IED) (2010/75/EU)[56] is the main EU instrument regulating pollutant emissions from industrial installations and aims to achieve a high level of protection of human health and the environment taken as a whole by reducing harmful industrial emissions across the EU, in particular through better application of the best available techniques. The IED is implemented in the UK through the Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2013 and is applicable to combustion installations of 50 megawatt thermal (MWth) or over.

A BAT Reference (BREF) on Large Combustion Plants (LCP BREF) is in the final stages of development. It sets BAT Associated Emissions Limits (AELs) for NO_x and CO and suggests that Dry Low Emission (DLE) (a technology that reduces NO_x emissions from gas-fired turbines) is the best available technique for offshore turbines. The BREF is expected to be published in the *Official European Journal* in the first half of 2017.

Oil & Gas UK continues to monitor developments of the BREF in Europe. The association's Atmospherics Technical Group is engaging with BEIS to discuss implementation issues including physical stack emission monitoring and derogation process from the AELs in the BREF.

LCP BREF Decision Tool

Oil & Gas UK has developed a decision tool to help members establish which combustion plant and combustion units fall within the scope of the LCP BREF outlined above and therefore are subject to the Emission Limit Values. The tool was trialled by members of Oil & Gas UK's Atmospherics Technical Group and is available to the wider membership from the Oil & Gas UK Health, Safety and Enviroment Team.

Oil Spill Response Tools

Through its Oil Spill Response Forum, Oil & Gas UK has facilitated several collaborative and multi-stakeholder projects in 2015-16 to continue to improve industry's knowledge of the marine environment and aid compliance with the requirements under the Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation Convention) (Amendment) Regulations 2015. The outputs and tools from these projects were released in 2016:

- **An update to the Seabirds Oil Sensitivity Index (SOSI) –** the index that describes seabird sensitivities to accidental oil releases offshore has been updated to take into account the wealth of new survey data that has been collected and to take the opportunity to review the method and factors used in calculating the SOSI in light of new science. The SOSI has been generated as GIS layers and will be released through the Joint Nature Conservation Committee website shortly.

- **Coastal Sensitivity Mapping –** the aim of this study was to collate and map information about coastal areas required for oil spill planning and response in Scotland, including environmental and socioeconomic data. The GIS layers are available to download through the Marine Scotland National Marine Plan Interactive website[57].

- **Monitoring Capability Assessment –** this study gathered information on the capability of the UK industry and wider scientific community to monitor an offshore accidental oil release event on the UKCS. Data have been gathered on the availability of equipment, vessels and people with recommendations on where to focus resources in the first 12 to 24 hours of an incident to assess potential impacts and inform operational response decisions. The output of this study has been shared at the PREMIAM conference in June 2016 (for a group of government departments and agencies who may undertake monitoring in a spill).

[56] See http://bit.ly/EUie10
[57] See http://www.gov.scot/Topics/marine/seamanagement/nmpihome

6.2 Consultations

Oil & Gas UK has co-ordinated responses to several consultations on behalf of members including on Energy Efficiency Tax, the English Special Areas of Conservation for Harbour Porpoise, the Environment Audit Committee Inquiry into Marine Protected Areas, changes to the Good Environmental Status Decision, and the consultation on BEIS charging for advice on oil in water and chemical permits.

Oil & Gas UK also continues to engage in discussions on potential EU legislation and guidance and its impact on the industry. For example, the European Commission's Department for the Environment has proposed the development of a Hydrocarbon BAT document covering the environmental aspects of all stages of the hydrocarbon exploration and production process. The Hydrocarbon BAT is being developed for the commission by Amec Foster Wheeler. Oil & Gas UK will attend the Technical Working Group discussion on the scope of the document to ensure any initiatives add value, rather than negatively impact the industry.

Following the UK's vote to leave the EU, Oil & Gas UK has been monitoring developments closely, gathering intelligence and analysing the implications for the oil and gas industry. A survey of members on the key issues impacting the industry will help to inform the trade body's policy positions.

6.3 Standardisation and Efficiency in Environmental Management

Improving efficiency in oil and gas production on the UKCS is an area of important focus for the industry to reduce costs and improve the sector's competitiveness.

Oil & Gas UK's Environment Operators Technical Group has been working on the standardisation and simplification of approaches in several areas of environmental management including:

- Chemical permitting to reduce the administrative burden and iterations of the permits.

- Smarter thinking for seabed survey strategies that aims to encourage standardisation while gaining greater understanding of the effect of oil and gas activity on the seabed.

- Developing a consistent definition for environmental critical elements (ECE) as "critical equipment which should they fail would result in a loss of contaminant which would result in a major pollution incident and significant environmental impact". This was tested at a generic Environmental Impact Identification (ENVID)[58] review to identify common pieces of equipment across industry likely to be ECE.

- Oil & Gas UK's Atmospheric and Drilling Fluids Technical Work Groups have continued to provide support and review comments on new draft guidance to BEIS on topics such as F-gas regulations and cement permitting to ensure operational challenges with the proposals are fully appreciated and to ensure standard approaches within industry.

[58] The ENVID review enables identification of environmental aspects that come about due to an interaction between the facility and its surroundings in order to plan for, avoid, or mitigate their potential impacts.

7. Appendix

7.1 Produced Water and Chemicals

Regulatory Landscape

Discharging of produced water is carefully controlled through the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005 (OPPC regulations)[59], which prohibit the discharge of oil to sea other than in accordance with the terms and conditions of a permit. Operators of offshore installations must identify all planned oil discharges to relevant waters and apply for the appropriate OPPC permits.

Discharge of chemicals into the marine environment is governed in the UK under the Offshore Chemical Regulations 2002[60] (as amended 2011)[61]. The offshore oil and gas industry uses chemicals in the exploration and production of hydrocarbons. Usage is kept strictly to the amounts required for the designated task to avoid waste and to reduce environmental impact. These chemicals can be split into three main groups: drilling chemicals, production chemicals and pipeline chemicals. BEIS (formerly the Department of Energy and Climate Change) must permit these discharges in advance through approval of drilling, production and pipeline operations applications submitted to its Oil Portal.

The Offshore Chemical Regulations 2002 (as amended) were introduced to implement the OSPAR recommendation for a harmonised mandatory control system for the use and discharge of chemicals by the offshore oil and gas industry. This is the overarching legislation to manage chemical discharges offshore.

Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)[62] is also a key piece of EU legislation that addresses the production and use of chemical substances, and their potential impacts on human health and the environment.

Only chemicals that have been registered with the Centre for Environment, Fisheries and Aquaculture Science's (CEFAS) Offshore Chemical Notification Scheme (OCNS) are permitted for use and discharge. The OCNS applies the OSPAR Harmonised Mandatory Control Scheme (HMCS), developed through OSPAR Decision 2002/2 (as amended by OSPAR Decision 2005/1) and its supporting recommendation. The OSPAR HMCS contains a list of chemicals considered by OSPAR to Pose Little Or NO Risk (PLONOR) to the environment, as well as those for which there is a substitution warning (SUB) where a less environmentally hazardous alternative should be used if practicable. Operators must consider these classifications and others within the CEFAS OCNS scheme as part of their risk assessment on chemical discharge. The REACH Enforcement Regulations 2008 require users, manufacturers and importers of substances to evaluate and control the risks associated with their use.

[59] See http://bit.ly/OPAreg05
[60] See http://bit.ly/OCreg02
[61] See http://bit.ly/OCamend11
[62] See https://echa.europa.eu/regulations/reach

Chemical Classification

CEFAS uses the Chemical Hazard and Risk Management (CHARM)[63] model to rank offshore chemicals according to their calculated hazard quotients (the ratio of Predicted Environmental Concentration (PEC)[64] to Predicted No Effect Concentration (PNEC)[65]). Inorganic and organic chemicals with functions for which the CHARM model has no algorithms are ranked using the CEFAS OCNS hazard groups[66]. With these tools, operators can assess the likely effect of discharging specific chemicals into the marine environment and employ management methods to minimise environmental risk while maintaining operational performance.

Hazard Ranking	Components
PLONOR	The PLONOR category includes all those products for which PON1s were submitted that have been assigned PLONOR (Pose Little Or NO Risk) status by BEIS.
Low	The Low Hazard category includes OCNS groups D and E, gold and silver as the lowest ecotoxicity groupings. This excludes products that have official PLONOR rankings.
Medium	The Medium Hazard category includes OCNS groups B and C as medium ecotoxicity groupings.
High	The High Hazard category includes OCNS group A, as the highest ecotoxicity grouping.
Unattributable	The remaining category includes all of those products for which sufficient description is not given and therefore they cannot be categorised in this model.

The Norwegian authorities use an alternative classification system for chemical discharges on the Norwegian Continental Shelf[67]. The Norwegian categories are: green (chemicals considered to have no or limited environmental impact); yellow (chemicals in use but not covered by the other categories); red (chemicals that are environmentally hazardous and should be replaced); and black (chemicals prohibited for discharge except under special permits). Green and yellow chemicals can be discharged without specific conditions while red chemicals must have a permit. Based on these definitions, it is reasonable to equate green with PLONOR and red with SUB. Yellow and black chemicals cannot be equated to UKCS categories.

7.2 Atmospheric Emissions

Regulatory Landscape

Atmospheric emissions from the offshore oil and gas industry are controlled by several pieces of legislation that require operators to undertake emissions monitoring, reporting and management measures. There are over 20 atmospherics-related European legal instruments that are applicable to various different sites in the oil and gas industry.

Atmospheric emissions must be reported to BEIS through EEMS. These data are based on calculations and direct measurements derived from emissions monitoring carried out in accordance with each relevant scheme. BEIS then uses the EEMS data for its reporting requirements for a number of international conventions and EU legislation.

[63] See http://bit.ly/CHARM16
[64] PEC is an indication of the expected concentration of a material in the environment. It considers the amount initially present in the environment, its distribution and rates of degradation and removal, either forced or natural.
[65] PNEC represents the concentration below which exposure to a substance is not expected to cause adverse effects to species in the environment.
[66] This hazard ranking system does not take into account the mass of the releases and therefore is not a measure of risk to the environment.
[67] These categories are detailed in the Norske Olje & Gass 2014 *Environmental Report* available at http://bit.ly/NOGenvironmental

The Greenhouse Gas Regulations 2012 implement the requirements of the EU ETS in the UK. The regulations stipulate that participants must hold a permit to emit GHGs. A monitoring and reporting plan must also be followed, which is approved by BEIS.

The EU ETS works on a 'cap and trade' basis. A 'cap' or limit is set on the total GHG emissions allowed by all participants covered by the scheme and this cap is converted into tradeable emission allowances. An allowance is a tradeable commodity equal to one tonne of carbon. For each installation, allowances must be surrendered to the Environment Agency equal to the total amount of emissions generated each year. Participants can surrender freely allocated allowances, buy allowances (EU Allowances) from the market and/or undertake measures to reduce emissions[68].

The Carbon Reduction Commitment (CRC) stipulates that organisations using large amounts of energy must record and annually publish information on their energy usage, with a view to improving energy efficiency and reducing CO_2 emissions. The CRC is designed to reduce CO_2 emissions that are not already covered by the EU ETS. For the offshore oil and gas industry, CRC is mainly applicable to onshore offices. Participants must purchase allowances from the government or the secondary market (where a trader or other participant offers allowances for sale) and surrender allowances to the Environment Agency equal to the total amount of emissions generated[69].

The Energy Savings Opportunity Scheme Regulations 2014 implement the requirements of the EU Energy Efficiency Directive in the UK. This scheme stipulates that all businesses classified as large undertakings must complete an assessment of their total energy usage and carry out audits to identify energy-saving opportunities. Phase I was completed by December 2015[70].

The Offshore Combustion Installations (Prevention and Control of Pollution) Regulations 2013 (PPC Regulations) transpose the relevant provisions of the EU IED. Applicable installations must be run in accordance with a permit issued under these regulations. This includes undertaking a monitoring plan, agreed with BEIS for NO_x and other nitrogen compounds, SO_2 and other sulphur compounds, CO, and unburned hydrocarbons. Most installations are also required to undertake an energy assessment to ensure that the installation is being run in the most energy efficient manner that is financially viable[71].

The release of ozone-depleting substances is controlled by European Commission Regulation No 744/2010 amending No 1005/2009 with regard to the critical use of halons. Operators of refrigeration and air-conditioning systems, heat pumps and fire-protection equipment must prevent leaks of controlled substances (i.e. halons, CFCs, HCFCs and F-gases) and repair detectable leakages as soon as possible.

VOC emissions are controlled through the requirement for consent to vent applications under the Energy Act 1976. Applications require medium- and long-term plans for reducing venting.

[68] See www.gov.uk/guidance/participating-in-the-eu-ets
[69] See www.gov.uk/guidance/crc-energy-efficiency-scheme-qualification-and-registration
[70] See www.gov.uk/guidance/energy-savings-opportunity-scheme-esos
[71] See http://bit.ly/1Mhr4m3

7.3 Waste

Regulatory Landscape

Although offshore installations do not need a licence for waste generation and handling, there are a number of regulatory requirements that operators must adhere to. Many of these are contained within the International Convention for the Prevention of Pollution from Ships[72]. This was introduced into UK law through the Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008[73].

The 2008 regulations generally prohibit waste disposal in the offshore marine environment with the exception of ground food waste disposal beyond 12 miles from the coast. This means that all offshore oil and gas waste is generally returned to shore. Most food waste is returned to shore with the exception of small quantities of ground food waste that are discharged through drainage systems.

Every offshore oil and gas installation must hold a Garbage Management Plan that includes details of waste collection, storage and disposal measures. A Garbage Record Book must also be kept on site with a record of the waste passed to supply vessels for onshore disposal.

Although not directly applicable offshore, operators must be mindful of the onshore waste regulations as it is essential that the transfer of waste ashore is carried out in a way that allows these requirements to be met[74]. The original waste producer has a 'duty of care' to ensure waste is transferred and disposed of properly. Although the waste producer has the primary role, this duty of care also extends to any person who imports, produces, carries, keeps, treats or disposes of waste or, as a broker, has control of such waste. Waste producers may take the following steps in relation to their duty of care:

- Prevent waste being released through appropriate handling and storage
- Understand waste in their possession and accurately describe its contents
- Ensure waste is transferred to an appropriately licensed carrier
- Prevent waste from causing harm according to what is known and foreseeable
- Monitor waste through an Environmental Management System
- Report waste disposal data to EEMS on a monthly basis

[72] See http://bit.ly/ICPPS
[73] See www.legislation.gov.uk/uksi/2008/3257/contents/made
[74] Further information on onshore waste regulation can be found on Oil & Gas UK's Environment Legislation website at www.oilandgasukenvironmentallegislation.co.uk

8. Glossary

AELs	Associated Emission Limits
Anaerobic digesters	Micro-organisms that break down biodegradable material in the absence of oxygen
BAT	Best Available Technique
BEIS	Department for Business, Energy and Industrial Strategy
boe	barrels of oil equivalent
BREF	BAT Reference
Bq	Becquerel
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CFC	Chlorofluorocarbons
CH_4	Methane
CHARM	Chemical Hazard and Risk Management model
CO	Carbon monoxide
CO_2	Carbon dioxide
CO_2e	CO_2 equivalent
Condensate	A natural gas liquid with a low vapour pressure that generally occurs in association with natural gas.
CRC	Carbon Reduction Commitment
DLE	Dry Low Emission
ECE	Environmental Critical Elements
EEMS	Environmental Emissions Monitoring System
ENVID	Environmental Impact Identification
EU ETS	EU Emissions Trading System
F-gases	Fluorinated gases
Flaring	The controlled burning of natural gas in the course of oil and gas production operations
Fugitive emissions	Emissions due to weeps, seeps and leaks
GC-FID	Gas Chromatography – Flame Ionisation Detector
GHG	Greenhouse gases
GIS	Geographic Information System
HFCs	Hydrofluorocarbons
HMCS	Harmonised Mandatory Control Scheme
HSE	Health and Safety Executive
IED	Industrial Emissions Directive
IOGP	International Association of Oil & Gas Producers

LCP	Large Combustion Plant
Loss of containment	An unplanned or uncontrolled release of hydrocarbon or other substance from primary containment
MWth	Megawatt thermal
N_2O	Nitrous oxide
NORM	Naturally occurring radioactive materials
NO_x	Nitrogen oxides
OCNS	Offshore Chemical Notification Scheme
OGA	Oil and Gas Authority
OPEP	Oil Pollution Emergency Plan
OSPAR	The OSLO and Paris Convention for the protection of the marine environment of the North East Atlantic
PEC	Predicted Environmental Concentration
PFCs	Perfluorocarbons
PLONOR	Pose Little Or NO Risk – used by OSPAR to classify substances used and discharged offshore
PNEC	Predicted No Effect Concentration
PON1	Petroleum Operations Notice
Produced water	Water that comes to the surface with hydrocarbons during production, either naturally from the reservoir or after injection into the reservoir to displace oil and lift it to the surface.
Production efficiency	The total annual production divided by the maximum production potential of all fields on the UKCS
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SF_6	Sulphur hexafluoride
SO_x	Sulphur oxides
SOSI	Seabirds Oil Sensitivity Index
Stacked rig	Reducing a crew on a rig to either zero or just a few key individuals and storing the rig in a harbour
SUB	SUB chemicals are those classified under OCNS as harmful and should be phased out and substituted with a less harmful substance.
UKCS	UK Continental Shelf
Venting	The controlled release of gases into the atmosphere in the course of oil and gas production operations
VOCs	Volatile Organic Compounds
Well stream fluids	A term used to describe the total mass of fluids moving through the production systems. This includes produced water and oil in produced water; the produced water and oil reinjected; the total hydrocarbons produced (gas, oil and condensate).

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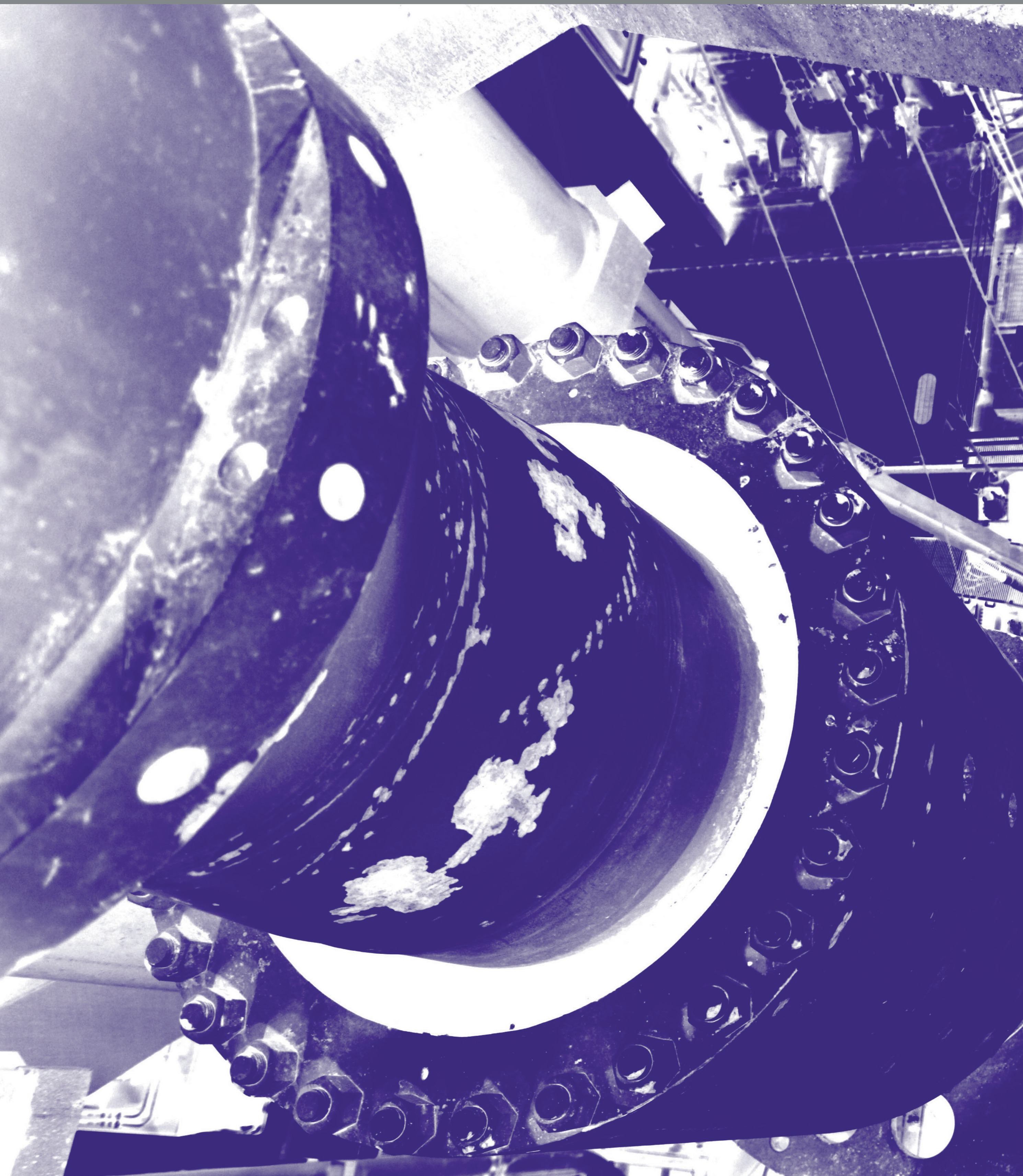

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