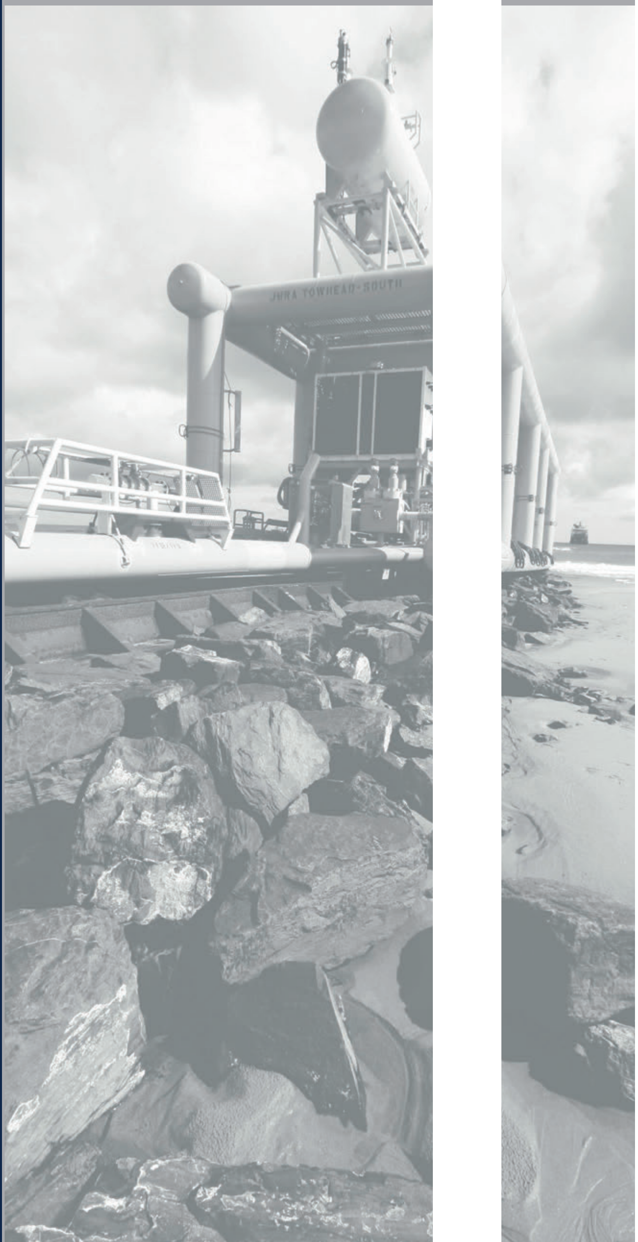
ENVIRONMENT REPORT 2015



Oil & Gas UK
the voice of the offshore industry

ENVIRONMENT REPORT 2015

OIL & GAS UK

Contents

1. Foreword

Welcome to the Oil & Gas UK *Environment Report 2015*. The environmental performance of the UK offshore oil and gas industry – captured via key metrics of emissions to atmosphere, discharges to sea, waste disposal and accidental releases – is highlighted in this report.

Data up to the end of 2014 – which is the latest complete dataset – are included, together with trends and detailed analysis, while key findings can be found in the executive summary. A non-attributed insight into the data – through a benchmarking exercise – that enables individual operating companies to compare their performance with others across the UK Continental Shelf (UKCS) is also provided.

While the upstream exploration and production industry is facing significant challenges – from the decline in oil price, increasing regulatory pressure with no environmental gain, and the debate around climate change – these must be balanced with society's requirements for a secure, reliable and affordable supply of energy, with oil and gas meeting those needs until at least the 2030s.

The long-term future of the industry on the UKCS will depend on its ability to operate more efficiently. This requires a co-operative approach from the regulators, by providing a regime that ensures protection of the environment, while reducing unnecessary administration and bureaucracy.

The report demonstrates that the overall trends for emissions, discharges, wastes and accidental releases continue to head in the right direction.

We hope that you find Oil & Gas UK's 2015 *Environment Report* both informative and useful. To help improve and add value to next year's report, we welcome comments and questions from all stakeholders. Please address these to Mick Borwell, Environment Director, on mborwell@oilandgasuk.co.uk.

Mick Borwell
Environment Director, Oil & Gas UK

2. Executive Summary

Industry Emissions and Discharges

- The regulator, the Department of Energy & Climate Change (DECC), issues permits for discharges and emissions from offshore installations on the UK Continental Shelf (UKCS). The potential effects of any such discharge on the marine environment must be considered as part of the permit application.

- Discharges and emissions are closely monitored offshore and are recorded in the Environmental Emissions Monitoring System (EEMS) database. Analysis of data from 2000 to 2014 shows an overall general decrease in discharges and emissions. This is the result of careful management and application of the best available techniques by industry.

- The average concentration of oil discharged with produced water across the industry was 12.8 milligrammes/litre last year. This is less than half of the OSPAR[1] recommended limit and is the lowest concentration since 2000.

- The total amount of production, drilling and pipeline chemicals discharged in 2014 was 20 per cent lower than the previous year at 105,500 tonnes. More than 74 per cent (approximately 78,400 tonnes) of these discharges are classified as those that Pose Little Or NO Risk (PLONOR) to the environment.

- There was an overall decline in the total (both water and oil-based mud residue) cuttings discharged to sea last year compared to 2013. However, there was an increase of 4,000 tonnes in oil-based mud residue drill cuttings discharged to sea. All such cuttings with oil-based mud residue are treated so that the oil content is less than one per cent before they are discharged to sea.

- There was a 34 per cent increase in 2014 in the mass of oil-based mud residue cuttings returned for onshore disposal to over 68,000 tonnes.

- Emissions of carbon dioxide, nitrogen oxides, carbon monoxide, sulphur dioxide, volatile organic compounds and methane have steadily decreased since 2000.

- In 2014, just over 190,000 tonnes of waste were returned to shore from UK offshore oil and gas operations, of which over 55,000 tonnes were reused or recycled.

- There was an 18 per cent reduction in operational waste when compared to 2013 bringing the total to just over 120,000 tonnes.

- Almost 90 per cent of decommissioning waste, mainly scrap metal, was reused or recycled in 2014.

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

Accidental Releases

- The UK oil and gas industry does its utmost to prevent accidental oil and chemical releases by investing heavily in physical barriers, such as downhole safety valves, maintenance to minimise leaks, as well as 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.

- Last year saw the smallest mass of accidental oil releases on record at just under 20 tonnes, representing 0.00003 per cent of the total oil production in 2014.

- The average size of accidental oil releases has fallen from 0.56 tonnes in 2010 to 0.07 tonnes in 2014, with no single releases last year greater than ten tonnes of oil.

- Similarly, there has been a decline in the mass of accidental chemical releases from 640 tonnes in 2010 to 110 tonnes in 2014. Eighty-eight per cent of the accidental chemical releases between 2010 and 2014 were PLONOR and low hazard chemicals. Last year, accidental chemical releases made up 0.03 per cent of the total chemicals used on the UKCS.

- The average size of accidental chemical releases has fallen from 3.98 tonnes in 2010 to 0.61 tonnes in 2014. There were no accidental releases greater than 200 tonnes of chemicals last year.

Oil & Gas UK

- From 2014 to 2015, Oil & Gas UK has been working with its members to improve efficiency in the environmental management of exploration and production operations by standardising environmental management practices; working together to reduce duplication and provide evidence to consultations jointly; and by minimising the administrative burden of new legislation by working closely with key stakeholders in the UK Government and from the EU. This work aims to improve efficiency in process while maintaining current levels of environmental protection.

- Further efficiency improvements are achievable through continued effort by industry and the regulators and a proportional approach to environmental management based on the level of environmental risk posed. Such an approach would allow effort and resources to be sensibly focused on the areas of greatest risk and potentially significant impact.

3. Emissions and Discharges Offshore

3.1 Introduction

Production on the UKCS peaked in 2000 at 1,719 million barrels of oil equivalent (boe) and has been declining since. In 2014, just over 545 million boe were produced[2], 0.2 per cent lower than in the previous year. As a mature basin, the UKCS has to meet several challenges, including how to continuously improve environmental performance and efficiency as production of oil and gas becomes more technically difficult. This chapter highlights that, in general, emissions and discharges across the UKCS are falling even as production demands more energy intensive techniques. A comparison with Norwegian[3] and international[4] data from 2013 is also provided where available.

3.2 Produced Water

Produced water is 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. The water is separated from oil and gas during the first stages of processing on the installation and discharged to sea after treatment to minimise the impact on the marine environment. Approval for produced water discharge is gained by applying for an oil discharge permit through the DECC UK Oil Portal[5] under the Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005.

Produced Water Volumes

The total amount of produced water handled on the UKCS remains comparable year-on-year from 2010 to 2014 despite an overall decline in hydrocarbon production. This is because, in a mature basin, as hydrocarbons become harder to reach and extract, larger volumes of water are produced. In 2014, produced water at 188 million cubic metres accounted for 88 per cent of the total well stream fluids[6].

Nonetheless, since 2000, there has been a net 40 per cent decrease in the volume of produced water actually discharged to sea from 263 million cubic metres to 157 million cubic metres (see Figure 1 opposite). This indicates that careful management measures and the Best Available Techniques are being implemented to minimise discharge.

[2] This data come from the DECC Energy Trends bulletin: www.gov.uk/government/collections/energy-trends

[3] The Norske Olje & Gass 2014 *Environmental Report* is available to download at www.norskoljeoggass.no/en/Publica/Environmental-reports/Environmental-report-2014/

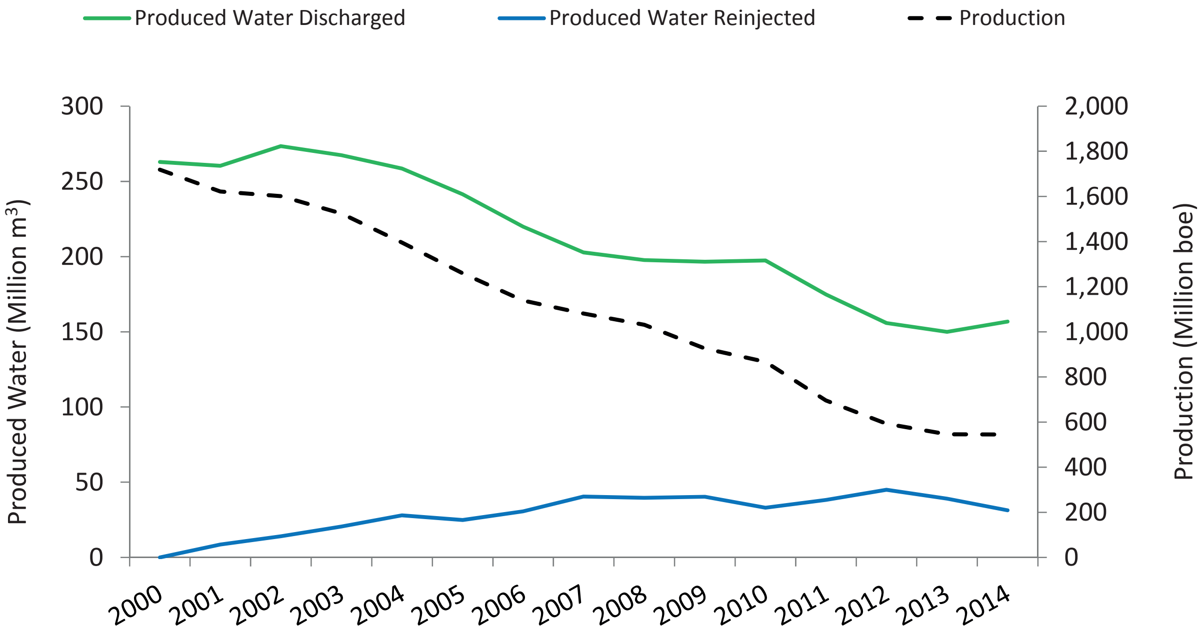
[4] The International Association of Oil & Gas Producers (IOGP) *Environmental Performance Indicators – 2013 Data* is available to download at www.iogp.org/pubs/2013e.pdf

[5] The UK Oil Portal allows operators to apply for and receive consents and permits. See https://itportal.decc.gov.uk/eng/fox/live/PORTAL_LOGIN/login

[6] 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); and the total fuel gas use and gas flared. Source for all these variables is EEMS data.

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 17 per cent (just over 31 million cubic metres) of the total produced water in 2014 was reinjected. While this is the lowest reinjection volume since 2006, it is consistent with the general trend since 2009 of reinjecting approximately one fifth of the total volume of produced water.

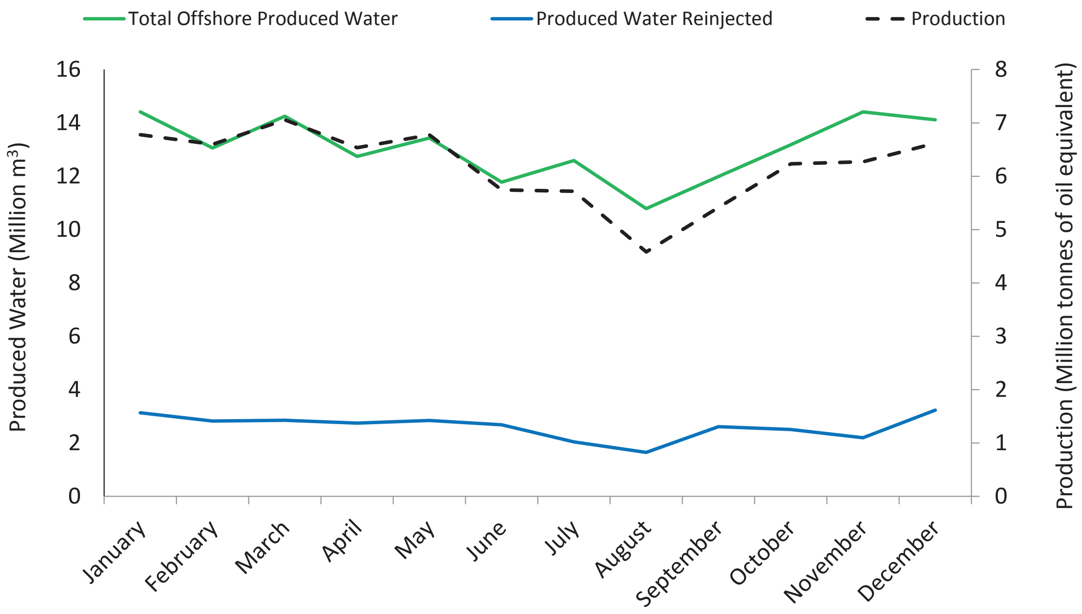
Figure 1: Total Produced Water Discharged to Sea and Reinjected versus Production



Source: EEMS June 2015, DECC

Figure 2 shows the monthly variation in produced water generation and reinjection over 2014, which roughly correlates with the monthly variation in production. Produced water volumes declined between July and September, coinciding with the offshore summer maintenance when there is a temporary halt in production on some assets.

Figure 2: Produced Water Generated and Reinjection Volumes throughout 2014



Source: EEMS June 2015, DECC

The International Association of Oil & Gas Producers (IOGP) reports that globally 0.6 tonnes of produced water was discharged and a tonne reinjected per tonne of hydrocarbon produced (both onshore and offshore) by IOGP member companies in 2013. Over 90 per cent of the reported produced water came from offshore operations.

Comparatively, in 2013, the UKCS discharged two tonnes and reinjected 0.5 tonnes of produced water per tonne of hydrocarbon produced. In 2014, these values were 2.1 tonnes and 0.4 tonnes, respectively. These data highlight the UKCS' maturity and its technically challenging nature compared with many other basins around the world. It is to be expected that more produced water is generated in the UK than on average globally. Nevertheless, continually decreasing discharge from the UKCS (see Figure 1 earlier) shows that produced water is controlled and managed.

Furthermore, both the Norwegian and UK ratios of produced water to hydrocarbons produced show a steady increase since 2000, reflecting that both countries face similar technical challenges with production in the North Sea basin. Norsk Olje & Gass reports that 1.9 tonnes of produced water was generated for every tonne of oil produced in 2013 in Norway.

Produced Water Composition

While produced water mainly consists of water, it does accumulate small amounts of naturally occurring substances through contact with the reservoir rock, including dispersed oil, dissolved organic compounds and naturally occurring radioactive material (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.

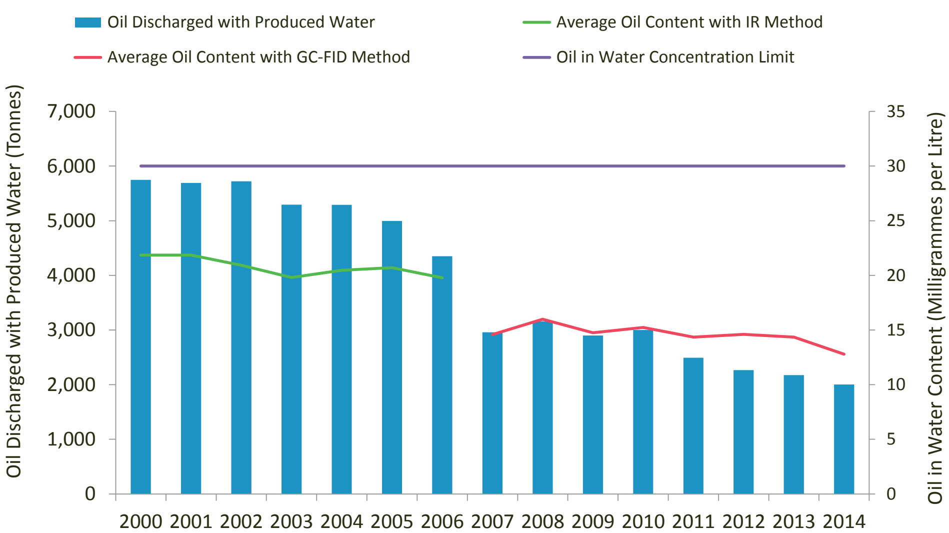
Oil in Produced Water

In 2014, around 2,000 tonnes of oil were discharged with produced water, making up just over 0.001 per cent of the total mass of produced water discharged. This is similar to the 2013 value, showing consistent management. Produced water is sampled and analysed for hydrocarbon concentrations on a daily basis offshore and this is recorded in the EEMS database. OSPAR 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 2014, the average concentration across the industry was less than half of this, at 12.8 mg/l, measured using the GC-FID method[7]. This is the lowest annual average on record since 2000 (see Figure 3 below).

There were slight variations in the average monthly concentrations of oil in water discharged over 2014 from 11.7 to 14.1 mg/l, with a rise during September coinciding with some hydrocarbon production coming back on-stream after the summer maintenance period.

IOGP reports that the global average oil content in produced water from offshore installations in 2013 was 13.4 mg/l. Norske Olje & Gass reports that a total of 1,542 tonnes of oil were discharged with produced water on the Norwegian Continental Shelf (NCS) in 2013, with an average concentration of 12.1 mg/l of oil in water. The 2013 UKCS average concentration was 14.4 mg/l, and is largely comparable to both the global and Norwegian values, as is the 2014 UKCS value of 12.8 mg/l.

Figure 3: Oil Discharged with Produced Water to Sea



Source: EEMS June 2015

[7] 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.

Naturally Occurring Radioactive Materials (NORM) in Produced Water

Discharges of NORM are controlled through permits issued under the Radioactive Substances Act (RSA) 1993[8]. Radium and many other radionuclides occur naturally in seawater and have done so for millions of years. Marine organisms have evolved to thrive with this background radioactivity, but significant bio-accumulation of radium would be of concern in the context of human consumption of fish.

The UKCS rock strata contains radionuclides of the Uranium and Thorium decay series and some of these dissolve into the water present in the reservoir. The most abundant NORM element in produced water is Radium (Ra)[9], and in particular the Ra^{226} isotope, which has a half-life of 1,620 years and emits alpha particles. As the water is brought to the surface, the reduced pressure and temperature results in the dissolved nuclides co-precipitating with barium sulphates[10] to form a scale on the inside of the process equipment. This NORM scale complex of barium, radium and sulphate is insoluble in seawater. Similarly, any radionuclides discharged in solution will form precipitates with sulphate rich seawater. These solids are not readily bio-accumulated in marine organisms and 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 Bequerel per millilitre (Bq/ml)[11].

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

[9] *Environmental Impacts of Produced Water and Drilling Waste Discharges from the Norwegian Offshore Petroleum Industry* Bakke, T., Klungsøyr, J., Sanni S. (2013) www.sciencedirect.com/science/article/pii/S0141113613001621

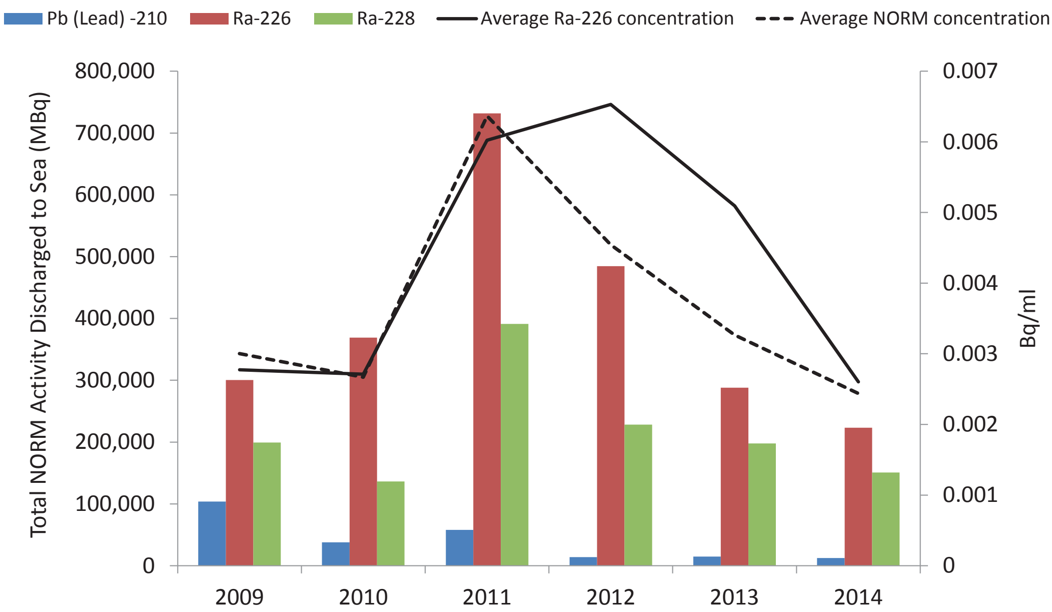
[10] Reservoir water is rich in barium and seawater is rich in sulphate, and so barium sulphate is formed when they meet.

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

Figure 4 below shows that there has been a consistent decrease in the amount of NORM discharged with produced water since 2011, and the current values are the lowest since 2009. The average Ra^{226} concentrations and the average total NORM concentrations are consistently and significantly below the 0.1 Bq/ml limit, both with a 2014 value of less than 0.003 Bq/ml.

Total NORM activity discharged is almost wholly dependent on the volume of produced water discharged. As an asset matures, there is potential for NORM scale to build up in pipework.

Figure 4: Breakdown of NORM Discharged in Produced Water



Source: EEMS June 2015

3.3 Chemicals

Discharge of chemicals into the marine environment is governed in the UK under the Offshore Chemical Regulations 2002[12] (as amended 2011)[13]. 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. DECC must permit these discharges in advance through approval of drilling, production and pipeline operations applications submitted to its Oil Portal.

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[14] Enforcement Regulations 2008 requires users, manufacturers and importers of substances to evaluate and control the risks associated with their use.

CEFAS uses the Chemical Hazard and Risk Management (CHARM)[15] model to rank offshore chemicals according to their calculated hazard quotients (the ratio of predicted environmental concentration (PEC)[16] to predicted no effect concentration (PNEC)[17]). Inorganic chemicals and organic chemicals with functions for which the CHARM model has no algorithms are ranked using the CEFAS OCNS hazard groups[18]. 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.

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[12] The Offshore Chemical Regulations are available to view at www.legislation.gov.uk/uksi/2002/1355/pdfs/uksi_20021355_en.pdf

[13] The 2011 Amendment is available to view at www.legislation.gov.uk/uksi/2011/982/contents/made

[14] Registration, Evaluation, Authorisation and restriction of Chemicals

[15] Information on the CHARM model is available at www.cefas.co.uk/publications-data/offshore-chemical-notification-scheme/hazard-assessment/

[16] 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.

[17] PNEC represents the concentration below which exposure to a substance is not expected to cause adverse effects to species in the environment.

[18] 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.

Mass of Chemicals Discharged

In 2014, just over 105,500 tonnes of chemicals were discharged to the marine environment (approximately 194 tonnes per million boe produced), of which almost 73 per cent (76,500 tonnes) was from drilling activities. The total amount of chemicals discharged has varied each year since 2000 (see Figure 5 overleaf) and is consistently dominated by the amount of drilling chemicals discharged. The 2014 total, however, was 20 per cent lower than the previous year.

All discharged chemicals dilute to levels that are not acutely toxic to marine organisms, reaching dilution of at least 1,000 times at a distance of 500 metres from the point of discharge. Those chemicals that are not used or discharged are returned to shore for reuse or disposal through various waste processing routes.

Specialist chemicals are used to produce 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. There is a net increase of just over 300 tonnes in the amount of production chemicals discharged between 2000 and 2014, despite decreasing production levels. This highlights the increasing complexity of production in a mature basin.

Pipeline chemicals are used for pipeline maintenance and include biocides and oxygen scavengers. Figure 7 overleaf shows that four times as many pipeline chemicals were used in 2014 than in 2013. The largest ten pipeline chemical discharges were from eight pipelines, all of which were either new or underwent major repair works in 2014[19]. All of these ten discharges, as well as 86 per cent of the total pipeline chemicals discharged, were PLONOR.

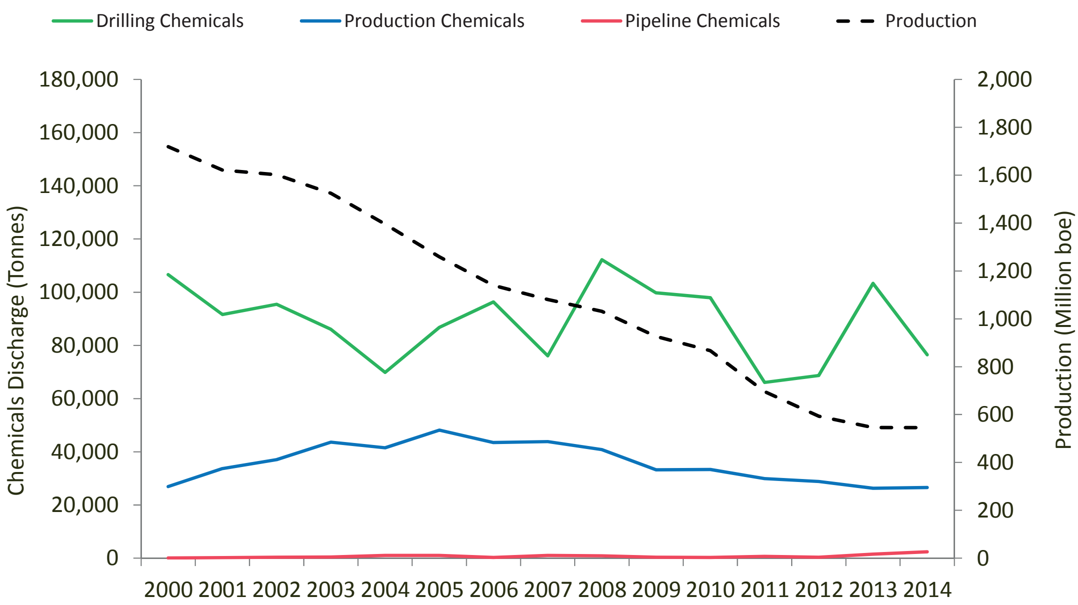
Drilling fluids are mostly made up of water, but also contain a range of chemicals to ensure wells can be drilled safely. Drilling fluids can increase the safety of operations by lubricating drilling equipment components, controlling well pressure and enabling drill cuttings to be removed. Cement and cement additives are also used in constructing wells. Figure 6 overleaf shows that, in 2014, just under four times more drilling fluids were used than discharged, reflecting the reuse of the fluids during drilling.

[19] These data are from the UK Oil and Gas Data website. See www.ukoilandgasdata.com

There has been a net decrease of 35,700 tonnes in the mass of drilling chemicals discharged since 2008, coinciding with a drop in drilling activity. When compared to the approximately 26 per cent fall in drilling chemicals discharged from 2013 to 2014, the increase in 2013 due to drilling of multiple wells was unusual[20].

Of the ten largest drilling chemical discharges last year, eight were from new wells.

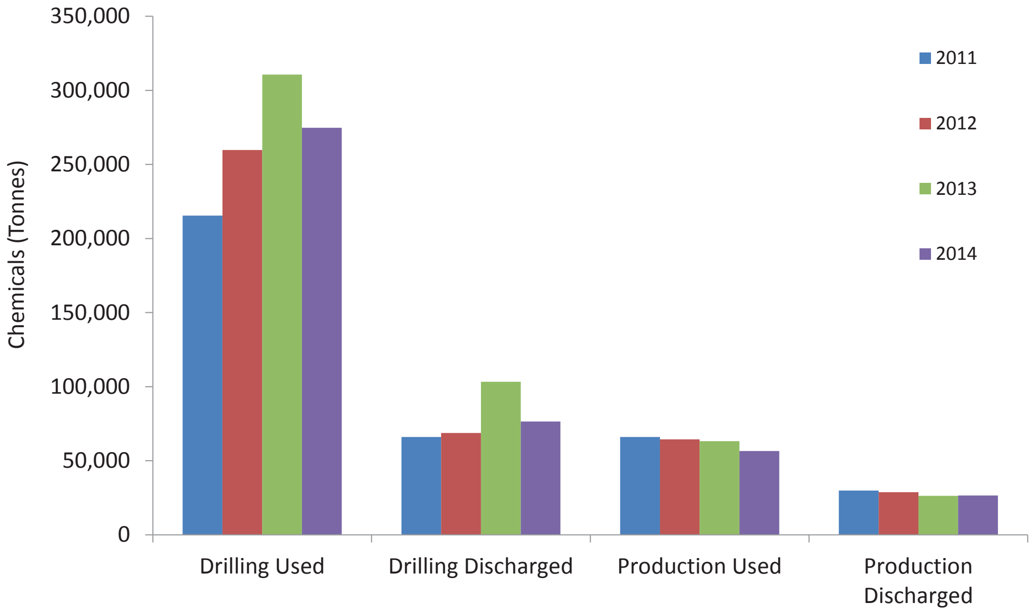
Figure 5: Production, Drilling and Pipeline Chemicals Discharged



Source: EEMS June 2015

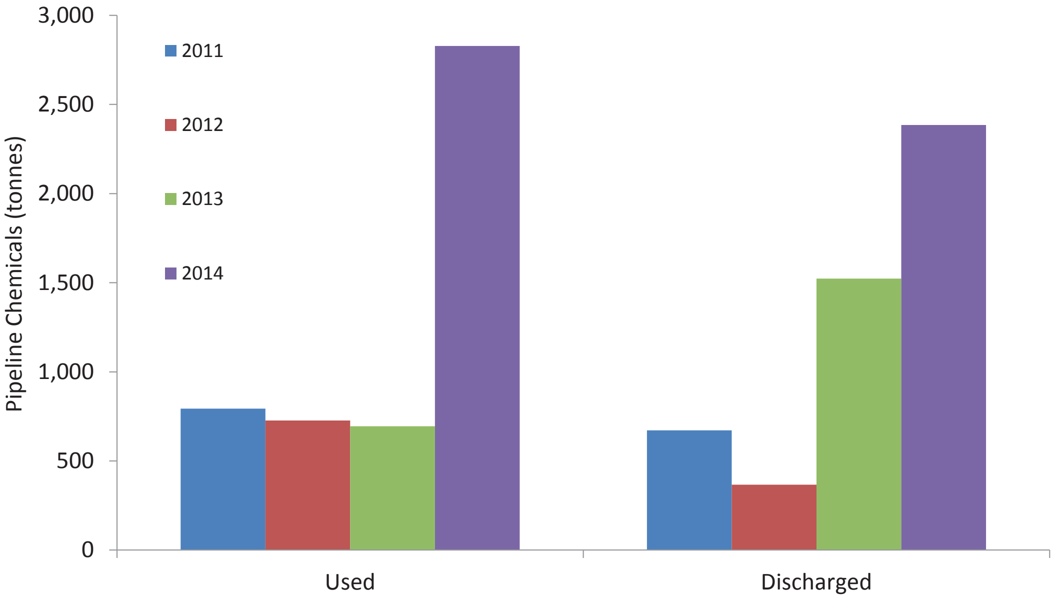
[20] In 2013, the mass of drilling chemicals discharged increased by 35 per cent from 2012. Analysis of the top ten largest drilling discharges shows that they are associated with multiple, rather than single, wells at the same site (a main well plus at least two sidetracks), increasing the overall length of wells drilled and hence the amount of chemicals used offshore.

Figure 6: Production and Drilling Chemicals Use and Discharge



Source: EEMS June 2015

Figure 7: Pipeline Chemicals Use and Discharge

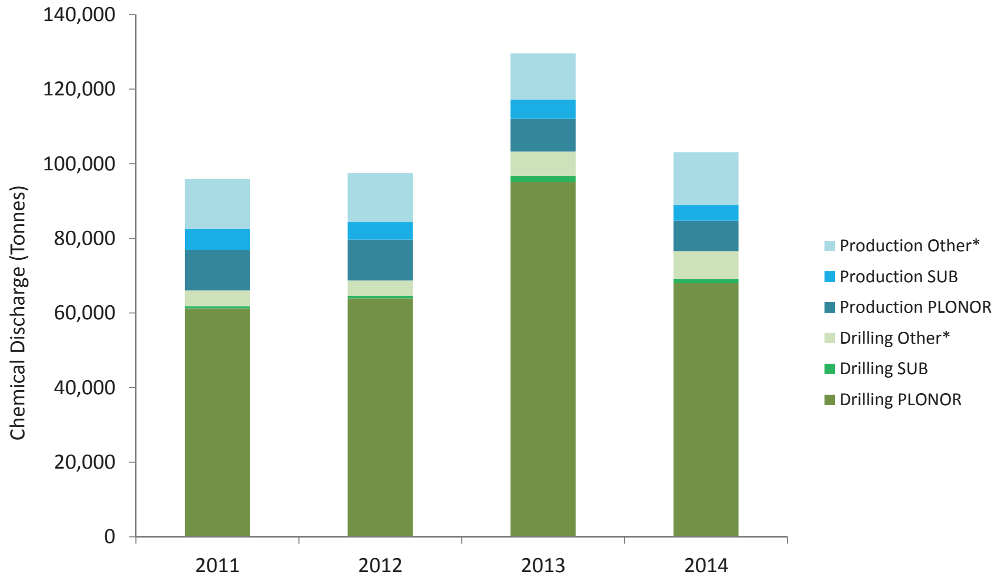


Source: EEMS June 2015

Composition of Chemicals Discharged

In 2014, more than 74 per cent (approximately 78,400 tonnes) of the total chemical discharges on the UKCS were PLONOR and five per cent (just over 5,300 tonnes) were classified as SUB. The remaining chemicals fall into other hazard categories and all were discharged under permit.

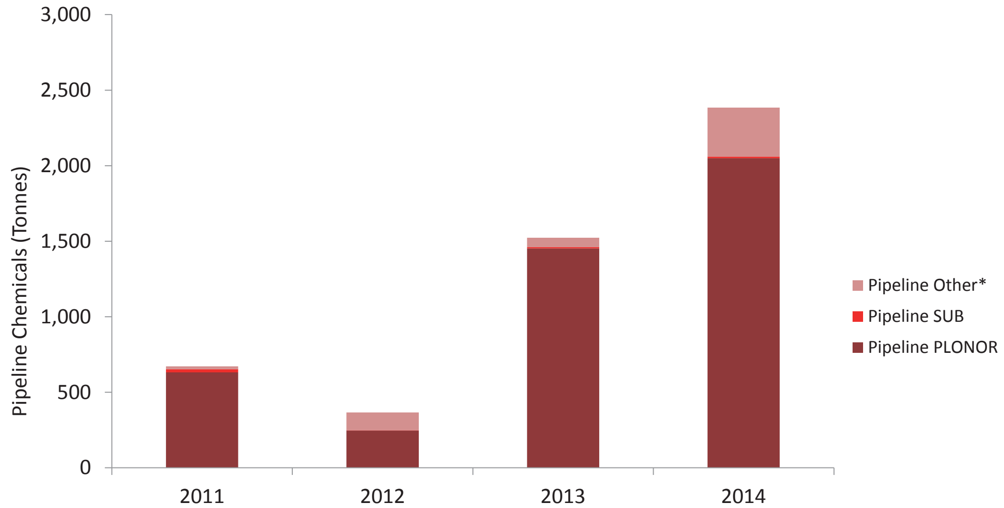
Figure 8: A Breakdown of Drilling and Production Chemicals Discharged by Classification



*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 June 2015

Figure 9: 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 June 2015

The Norwegian authorities use an alternative classification system for chemical discharges on the NCS[21]. 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.

In 2013, around 166,000 tonnes of chemicals were discharged on the NCS, which is about 130 tonnes per million boe produced. This is of the same order as the 2013 UKCS value of approximately 240 tonnes per million boe produced, and the 2014 value of 190 tonnes. Of those chemicals discharged on the NCS, 92 per cent fell into the green category and red and black made up 0.00004 per cent of the total discharged (less than seven tonnes of each).

3.4 Drill Cuttings

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

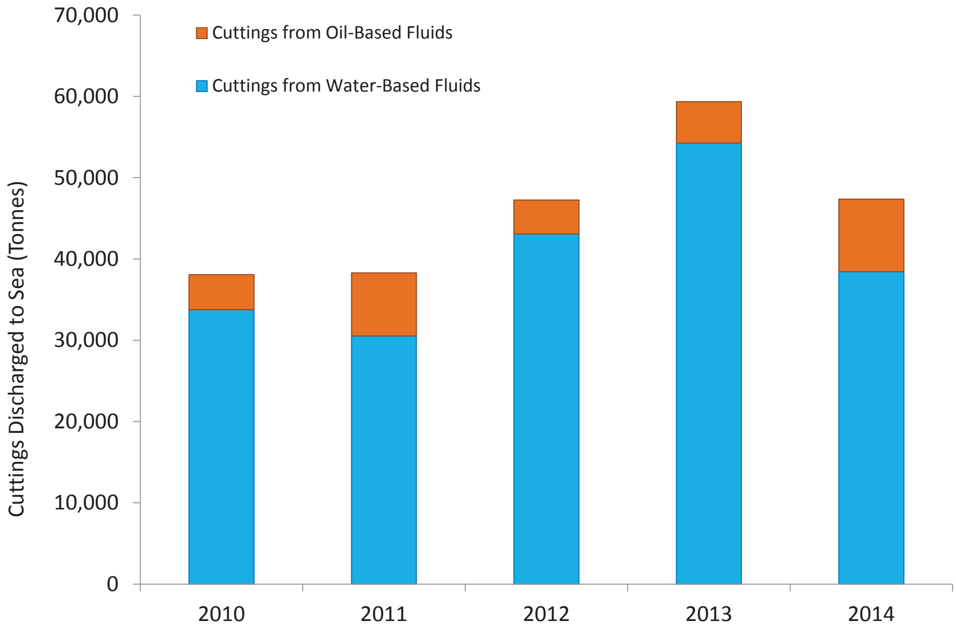
It is common practice to use both types of drilling fluids for various sections of the same well. Water-based fluids are generally applied in the upper sections while oil-based fluids are used in more technically demanding sections. The choice and composition of the drilling fluid depends on the characteristics of the rock strata and consideration of the safety and environmental risks. Oil-based mud is likely to be used in areas where water-based muds are not suitable, or where a well is drilled at an angle rather than vertically.

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

[21] These categories are detailed in the Norske Olje & Gass *2014 Environmental Report* available at www.norskoljeoggass.no/en/Publica/Environmental-reports/Environmental-report-2014/

Just over 38,000 tonnes of water-based cuttings and around 9,000 tonnes of treated oil-based fluid cuttings were discharged from offshore installations on the UKCS in 2014. This is approximately 12,000 tonnes less than was discharged in total the previous year. There was an increase, however, by nearly 4,000 tonnes of thermally-treated oil-based fluid cuttings discharged, reducing the requirement to ship this waste to shore. Approximately, 7,000 tonnes of oil-based cuttings were injected back into the reservoir (compared with 11,000 tonnes in 2013) consistent with the overall decline in cuttings generated, correlating to reduced drilling activity.

Figure 10: Cuttings Discharged to Sea



Source: EEMS June 2015

There is limited international data publically available on the discharge of drill cuttings, as less than half the IOGP reporting companies provided information on oil-based cuttings in 2013. Norske Olje & Gas reported a 25 per cent increase in the generation of oil-based mud cuttings between 2012 and 2013, none of which were reported as discharged to sea.

3.5 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.

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 DECC through EEMS. These data are based on calculations and direct measurements derived from emissions monitoring carried out in accordance with each relevant scheme. DECC then uses the EEMS data for its reporting requirements for a number of international conventions and European Union (EU) legislation.

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

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 (European Union Allowances (EUAs)) from the market and/or undertake measures to reduce emissions[22].

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[23].

The Energy Savings Opportunity Scheme (ESOS) Regulations 2014 implement the requirements of the EU Energy Efficiency Directive in the UK. This scheme stipulates that all businesses classed as large undertakings must complete an assessment of their total energy usage and carry out audits to identify energy saving opportunities. For Phase I, this must be completed by December 2015[24].

The Offshore Combustion Installations (Prevention and Control of Pollution) Regulations 2013 (PPC Regulations) transpose the relevant provisions of the EU Industrial Emissions Directive (IED). Applicable installations must be run in accordance with a permit issued under these regulations. This includes undertaking a monitoring plan, agreed with DECC, for NO_x and other nitrogen compounds, SO_2 and other sulphur compounds, CO, and unburned hydrocarbons (UHCs). 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[25].

[22] For more information visit www.gov.uk/guidance/participating-in-the-eu-ets
[23] For more information on CRC visit www.gov.uk/guidance/crc-energy-efficiency-scheme-qualification-and-registration
[24] For further information on ESOS visit www.gov.uk/guidance/energy-savings-opportunity-scheme-esos
[25] For more information on the PPC Regulations visit http://bit.ly/1Mhr4m3

Oil & Gas UK continues to monitor closely the development of the Large Combustion Plant Best Available Techniques Reference Document (LCP BREF) produced under the IED. The LCP BREF puts forward monitoring requirements and Best Available Techniques Associated Emissions Levels (BAT AELs) for CO and NO_x, which may be particularly challenging for some installations due to the unique operating conditions of turbines offshore.

The release of ozone depleting substances is controlled by European Commission (EC) Regulation No 744/2010 amending EC Regulation 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, chlorofluorocarbons (CFCs), hydrochlorofluorocarbons (HCFCs) and fluorinated gases (F-Gases)) and repair detectable leakages as soon as possible.

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

It is evident that there is a complex mixture of schemes in the UK that aim to improve energy efficiency and reduce GHGs. The offshore oil and gas industry would welcome a clearer and more efficient approach to offshore emissions legislation in the UK. Oil & Gas UK is actively working with the regulators to that end.

Trend Data

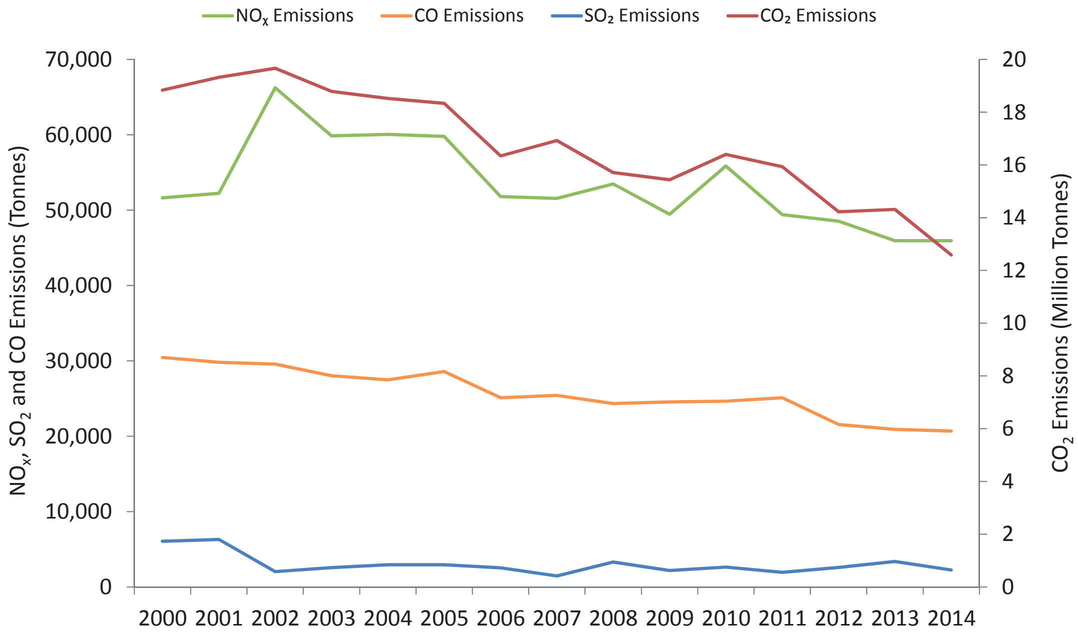
Figure 11 opposite shows that there has been a sustained decrease in CO_2 emissions offshore since the early 2000s. Factors such as the decline in production and volumes of produced water over the same period have been influential in reducing emissions. The introduction of key legislative instruments, such as the PPC Regulations and the EU ETS, has also led to energy efficiency management measures being implemented that may have aided emissions reductions. Market trading conditions, such as the EUA price and changes to the allocation of free allowances, may have had a role to play.

In the future, policy changes such as the introduction of the Market Stability Reserve (MSR) will have an increasing influence[26] as it is expected to increase the EUA price. A higher EUA price may influence decision making processes when evaluating the economics of emissions reductions measures, which are part of the wider petroleum economics context.

[26] For more information see Appendix A of Oil & Gas UK's *Economic Report 2015* available to download at www.oilandgasuk.co.uk/economicreport

In 2013, CO_2 emissions from UK offshore oil and gas production contributed three per cent of the total domestic CO_2 emissions[27]. It is important to consider that the exploration, production and transportation of offshore oil and gas account for a small percentage of the overall life cycle GHG emissions – approximately nine per cent for oil[28] and 16 per cent for gas[29].

Figure 11: Offshore Emissions of Carbon Dioxide, Nitrogen Oxides, Carbon Monoxide and Sulphur Dioxide



Source: EEMS June 2015

2014	CO_2	NO_x	CO	SO_2
Tonnes	12,585,700	46,000	20,700	2,200

[27] The data came from DECC. Values for 2014 were not available at the time of writing. See http://bit.ly/1H4faxf
[28] For more information see http://1.usa.gov/1GYdUvy. The data came from the US. UK data could not be sourced.
[29] For more information see www.worldwatch.org/system/files/pdf/Natural_Gas_LCA_Update_082511.pdf. The data came from the US. UK data could not be sourced.

As shown in Figure 12, 76 per cent of CO_2 emissions 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 equipment used in production processes, for electricity and heat, as well as compression equipment to enable gas to be transported ashore.

Gas flaring is also a source of CO_2 emissions. Flaring and venting are necessary offshore for maintenance, well testing and, most crucially, for the safety of offshore workers. Gas venting and flaring are both subject to consent under the Petroleum Act 1998, which aims to conserve gas by avoiding unnecessary wastage during hydrocarbon production.

Figure 12: Offshore Emissions Sources of Carbon Dioxide[30], Nitrogen Oxides, Carbon Monoxide and Sulphur Dioxide in 2014

Emissions Source	CO_2	NO_x	SO_2	CO
Fuel Consumption	76%	97%	93%	62%
Gas Flaring	24%	3%	7%	38%
Gas Venting	>1%	-	-	-

SO_2 emissions have remained steady since 2000. Last year, small amounts of SO_2 emissions were released mainly through fuel combustion. In 2013, SO_2 emissions from offshore oil and gas made up less than one per cent of the total UK SO_2 emissions[31].

CO emissions have also been declining since 2000. Although NO_x emissions have been variable, 2014 NO_x emissions are 11 per cent lower than levels in 2000. The variability in NO_x emissions could be attributable to changes in the need for diesel usage when reservoir gas supply is unavailable. This can be caused by several factors including: drilling activity, new installations being brought online, maintenance turnarounds, turbine 'trips 'or disruption to the gas supply. Last year, 46,000 tonnes of NO_x were released offshore.

While relatively smaller amounts of CO and NO_x can be emitted through flaring, the majority of NO_x and CO emissions come from combustion equipment such as turbines, engines and heaters, with turbines being the largest contributor. Reducing both NO_x and CO from offshore turbines is quite complex and often challenging. This is due to the unique operating conditions experienced offshore. The majority of offshore turbines are run in load share (i.e. two or more turbines share the load) at low loads of less than 70 per cent. If one turbine experiences operating difficulties, the other turbine(s) can pick up the load quickly to ensure that power to the installation is maintained. This is a common operating practice on the UKCS due to the need for reliability in power generation as offshore installations are not connected to the national grid for power supply. This is essential for the safety of offshore workers. The need to maintain this operating procedure, as well as the technical challenges associated with running turbines with variable fuel gas quality, has meant that emissions reduction technologies such as Dry Low NO_x burners are not suitable for use in many circumstances offshore[32].

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[30] Fugitive emissions (leaks and other unintended or irregular releases) and emissions from oil loading are also small sources of CO_2 emissions

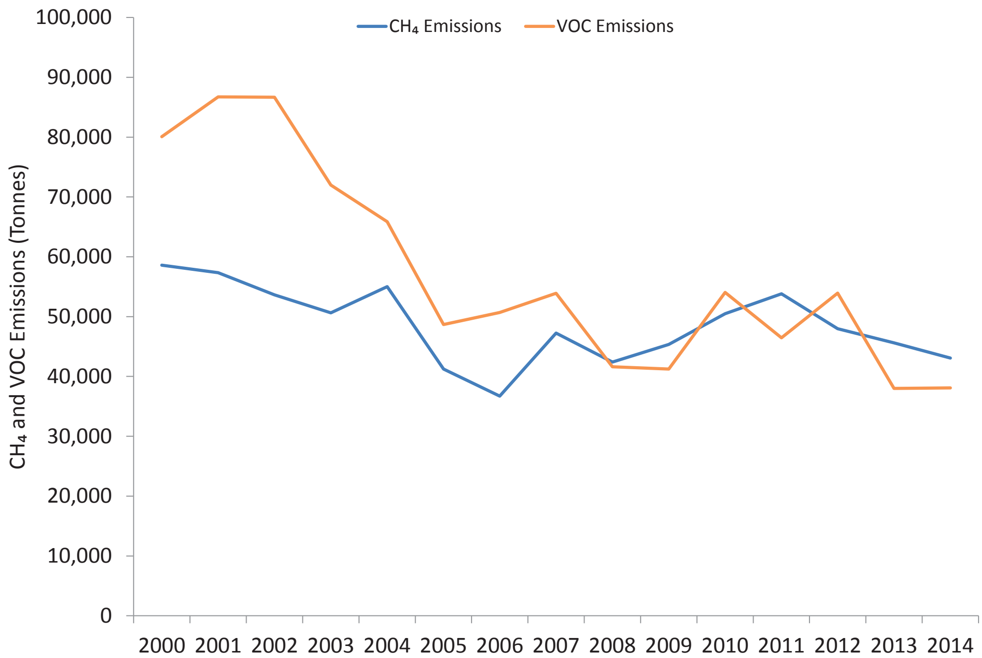
[31] 2014 data were not available at the time of writing. The data came from the Department for Environment, Food & Rural Affairs. See http://bit.ly/1MD8QNo

[32] Oil & Gas UK's Technical Note on *Offshore Gas Turbines and Dry Low NO_x Burners – An Analysis of the Performance Improvements (PI) Limited Database* is available to download at http://bit.ly/1MwT4jI

CO can be reduced from offshore installations by optimising combustion through a combination of techniques, including temperature management (e.g. efficient mixing of the fuel and combustion air) and residence time in the combustion zone. However, it is also important to note that there is a trade-off between the generation of CO and NO_x emissions due to their occurrence at different combustion temperatures, with CO emissions decreasing with rising temperatures and NO_x emissions increasing with rising temperatures.

Last year almost 38,100 tonnes of VOCs were emitted from offshore installations, a net 52 per cent reduction when compared to 2000. Meanwhile, 43,100 tonnes of CH_4 were emitted, a 27 per cent net reduction when compared to 2000.

Figure 13: Offshore Emissions of Methane and Volatile Organic Compounds



Source: EEMS June 2015

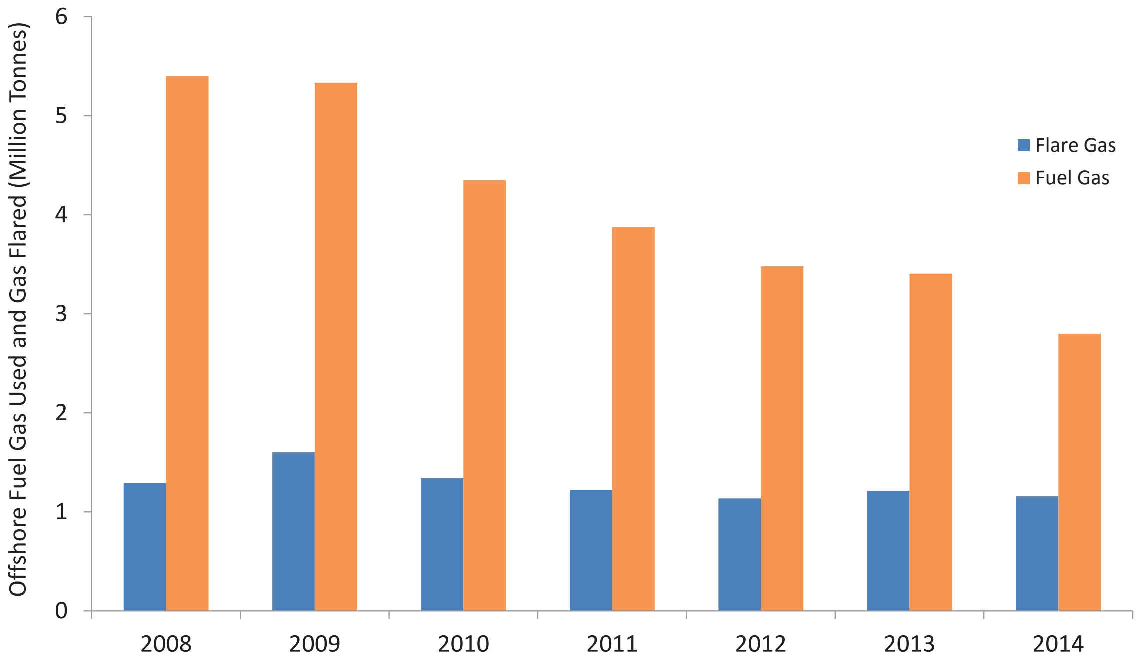
Figure 14 shows that the largest sources of VOC emissions in 2014 were gas flaring and venting (less than 66 per cent) and loading (29 per cent). A small amount of VOCs was also released due to fuel consumption. The decrease in VOCs seen in Figure 13 since 2000 is linked to declining production. The introduction of emissions reduction measures during loading, such as VOC recovery units, may also have been influential. The majority of CH_4 emissions are generated from venting and flaring.

Figure 14: Offshore Emissions Sources of Methane and Volatile Organic Compounds in 2014

Emissions Source	CH_4	VOC
Fuel Consumption	7%	3%
Fugitives	4%	3%
Gas Flaring	33%	<36%
Gas Venting	54%	30%
Oil Loading	>1%	29%

Figure 15 highlights that 1.2 million tonnes of gas were flared on the UKCS last year, a four per cent reduction on 2013. The decline in flaring activity may be related to the overall decline in production.

Figure 15: Comparison of Offshore Fuel Gas Used and Gas Flared



Source: EEMS June 2015

Potential Environmental Impacts

Atmospheric emissions have several potential environmental impacts. Releasing ozone depleting substances (ODS) such as halons can cause stratospheric ozone depletion.

The reaction between NO_x and VOCs in the atmosphere can cause ground level ozone formation, while SO_x and NO_x releases may result in acidification. The potential impact of ozone formation and acidification is mitigated by the geographical location of most offshore installations, which are hundreds of kilometres from the coastline and human populations.

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.

The global rise in GHG emissions has prompted calls to move to a lower carbon economy, a transition that must be achieved in a responsible manner. Everyday life depends heavily on ready access to affordable and reliable energy, as well as a variety of oil-derived products such as medicines, cosmetics, electronic equipment, plastics, fertilisers and cleaning products. In a world that is expected to experience increasing energy demand, it is evident that oil and gas has a key role to play even with rapid growth in renewables and improvements in efficiency. 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.

Divestment from oil and gas is not the solution and will only make the challenge of meeting global energy demand all the greater. It is important to stress that the largest producers of oil and gas are not privately owned or listed; they are government-owned companies. In addition, many oil and gas exploration and production companies are broadening their remit to include renewables.

Climate change is a global challenge that requires a joined-up global response. 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 nine per cent for oil and 16 per cent for gas.

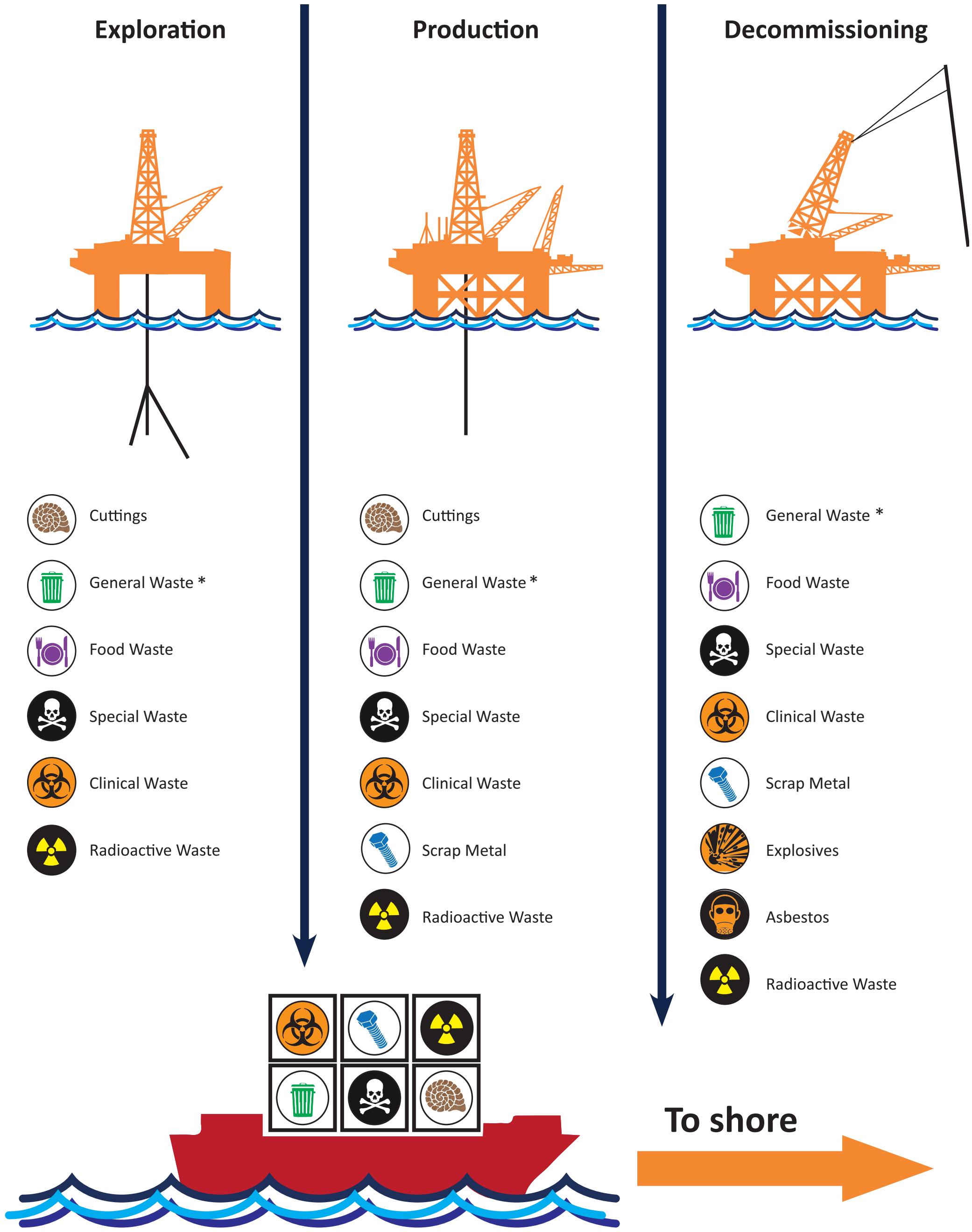
The offshore oil and gas industry continually strives to reduce emissions from operations by taking part in emissions trading schemes, implementing energy efficiency improvements and supply chain initiatives. Trials of new technologies such as carbon capture and storage (CCS) are also being explored.

The need to ensure equipment is maintained for safety and reliability reasons means that high levels of energy efficiency are sustained.

3.6 Waste

In any discussion on waste, it is important to understand the meaning of waste given the various definitions and interpretations that exist. According to the EU Waste Framework Directive (2008/98/EC) waste "means any substance or object which the holder discards or intends or is required to discard." As with the creation of any product, oil and gas production is associated with waste generation and disposal. As illustrated in Figure 16, waste originates at various points in the oil and gas life cycle and can be in different states, including solid, liquid, hazardous and non-hazardous (inert) materials.

Figure 16: Waste Generated Offshore by Waste Source



* General waste can include empty containers, segregated recyclables and liquid wastes. Special waste includes similar materials to general waste, however, these materials are generally classified as hazardous.

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.

Regulatory Landscape

Although offshore installations do not require a licence for waste generation and handling, there are a number of regulatory requirements that offshore facility operators must adhere to. Many of these are contained within the International Convention for the Prevention of Pollution from Ships (MARPOL) 1973. MARPOL was introduced into UK law through the Merchant Shipping (Prevention of Pollution by Sewage and Garbage from Ships) Regulations 2008.

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[33].

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 release of waste 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 (EMS)

Waste disposal data must be reported to EEMS on a monthly basis, forming the basis of the trend data analysis presented in the following sections.

[33] Further information on onshore waste regulation can be found on Oil & Gas UK's Environment Legislation website available at http://oilandgasukenvironmentallegislation.co.uk

Waste Mass

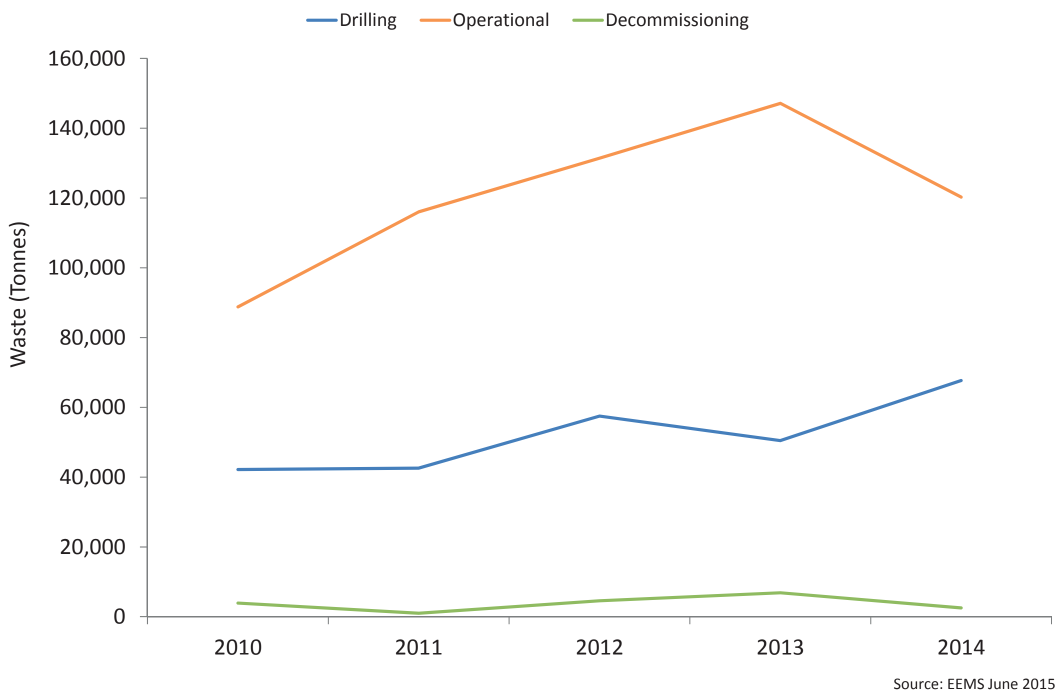
In 2014, just over 190,000 tonnes of waste materials were returned to shore from the UKCS. This represents a seven per cent reduction when compared to 2013 (over 204,000) and is the first reduction since 2009. The latest waste figures for the UK as a whole show that 200 million tonnes of waste were generated in 2012. This means that offshore oil and gas waste generated in 2012 at 193,000 represents 0.1 per cent of the UK total[34].

Just over 120,000 tonnes of operational waste were returned to shore in 2014, an 18 per cent fall compared to the previous year (see Figure 17). The reason for this is not clear. However, given that 2014 witnessed the best year-on-year production performance in 15 years, with a 0.2 per cent fall from 2013[35], and the level of planned maintenance shutdown activity for both 2013 and 2014 is similar, this points to improved waste management measures.

Conversely, the amount of drilling waste returned to shore increased by 34 per cent from 2013 to almost 68,000 tonnes. Although the total number of wells drilled (including sidetracks) has decreased slightly[36], the increase in drilling waste may be attributed to a number of longer wells being drilled and a higher number of repeat boreholes being drilled for certain wells, some of which were due to mechanical difficulties. The length of well drilled would be an accurate measurement of drilling activity, but this information is held confidentially for two years after the well has been completed.

Just over 2,500 tonnes were returned to shore as a result of decommissioning. Decommissioning waste is expected to increase significantly in the coming years as this area of the business grows[37].

Figure 17: Waste Generated Offshore by Activity



[34] As reported in the Department for Environment, Food & Rural Affairs *UK Statistics on Waste – 2010 to 2012* report, which is available to download at http://bit.ly/1MwUCdA. This was the latest data at the time of writing

[35] Oil & Gas UK's *Economic Report 2015* is available to download at www.oilandgasuk.co.uk/economicreport

[36] As reported in the Oil & Gas UK *Economic Report 2015*.

[37] Oil & Gas UK's *Decommissioning Insight 2015* is available to download at www.oilandgasuk.co.uk/market-forecasts.cfm

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Waste Composition

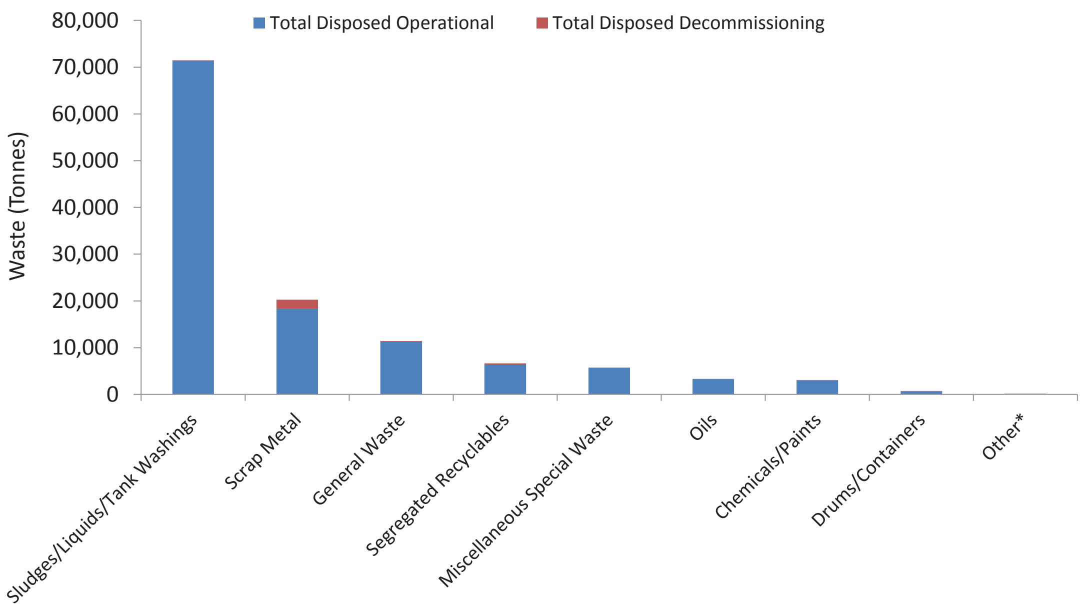
Last year, drill cuttings returned to shore were mainly made up of hazardous solids, hazardous oils and other hazardous liquids, such as oily water. Solids and liquids are classified as hazardous if they contain small amounts of oil. Once ashore, drill cuttings undergo thermal treatment that involves separating the solid rock fragments from the oil and liquids. The majority of cuttings were processed in the UK with just six per cent exported to the Netherlands for processing.

Sludges, liquids and tank washings make up the majority of wastes from operational and decommissioning activities, with over 71,000 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.

These wastes are then 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 then be used in renewable energy facilities such as anaerobic digesters[38]. Oil is recovered and usually reused as a fuel source and the cleaned solids are disposed of in a landfill.

The offshore industry generated almost 1,900 tonnes of scrap metal from decommissioning in 2014, which was all reused or recycled. Almost 90 per cent of the total decommissioning waste last year was reused or recycled.

Figure 18: Operational and Decommissioning Waste Generated Offshore by Category in 2014



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

Source: EEMS June 2015

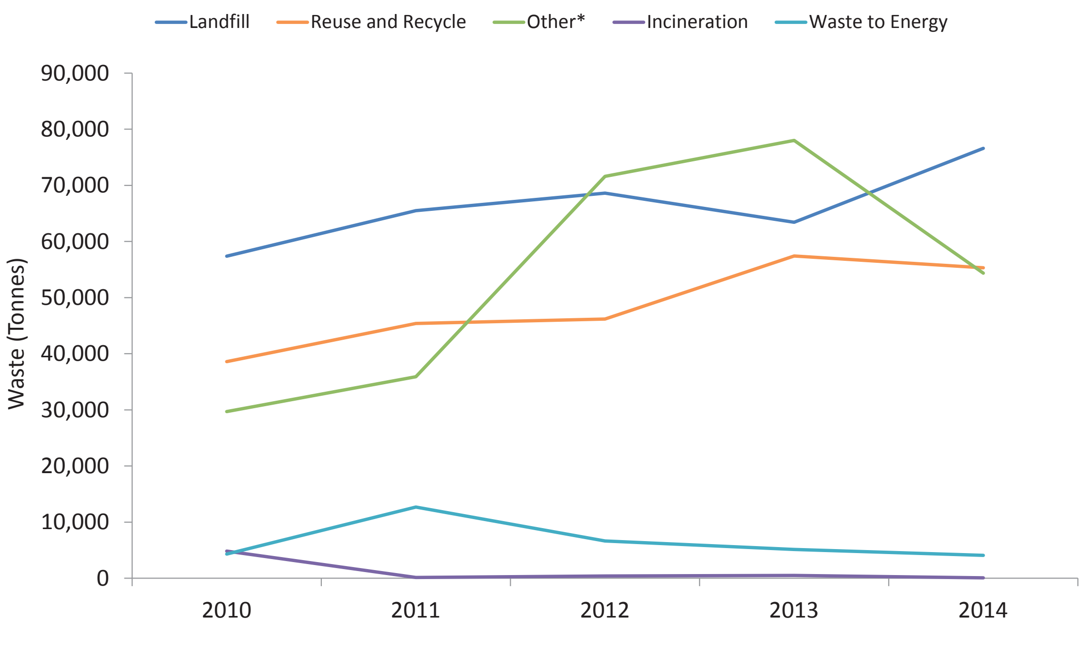
[38] Anaerobic digestion is the breakdown of biodegradable material by micro-organisms in the absence of oxygen.

Last year, the majority of waste was landed in the UK, with just two per cent transferred to the Netherlands for processing[39]. Figure 20 opposite shows the waste disposal route of all wastes returned to shore by waste port.

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 under 160,000 tonnes (84 per cent) of the total waste returned to shore landed in the north east of Scotland at ports in Aberdeen and Peterhead. Of this, 41 per cent or 66,000 tonnes was sent to a landfill for disposal, while 31 per cent (49,000 tonnes) was designated as “other” for other disposal routes such as treatment of aqueous wastes, composting and land spreading. Over 43,000 tonnes (27 per cent) were reused or recycled.

The high proportion of wastes recycled in Lerwick is due to the level of decommissioning in the northern North Sea area, while the availability of waste-to-energy facilities in England may contribute to the higher quantities of wastes disposed of through this route, particularly for wastes landed in Heysham, Immingham and Great Yarmouth. Although the amount of waste that is reused and recycled is steadily rising, there has also been an increase in the mass of waste returned to landfill in recent years. The cause of this increase in landfill waste is not clear, however, it will be analysed by the oil and gas industry through Oil & Gas UK’s Waste Technical Group.

Figure 19: Total[40] Waste Generated Offshore by Waste Disposal Route

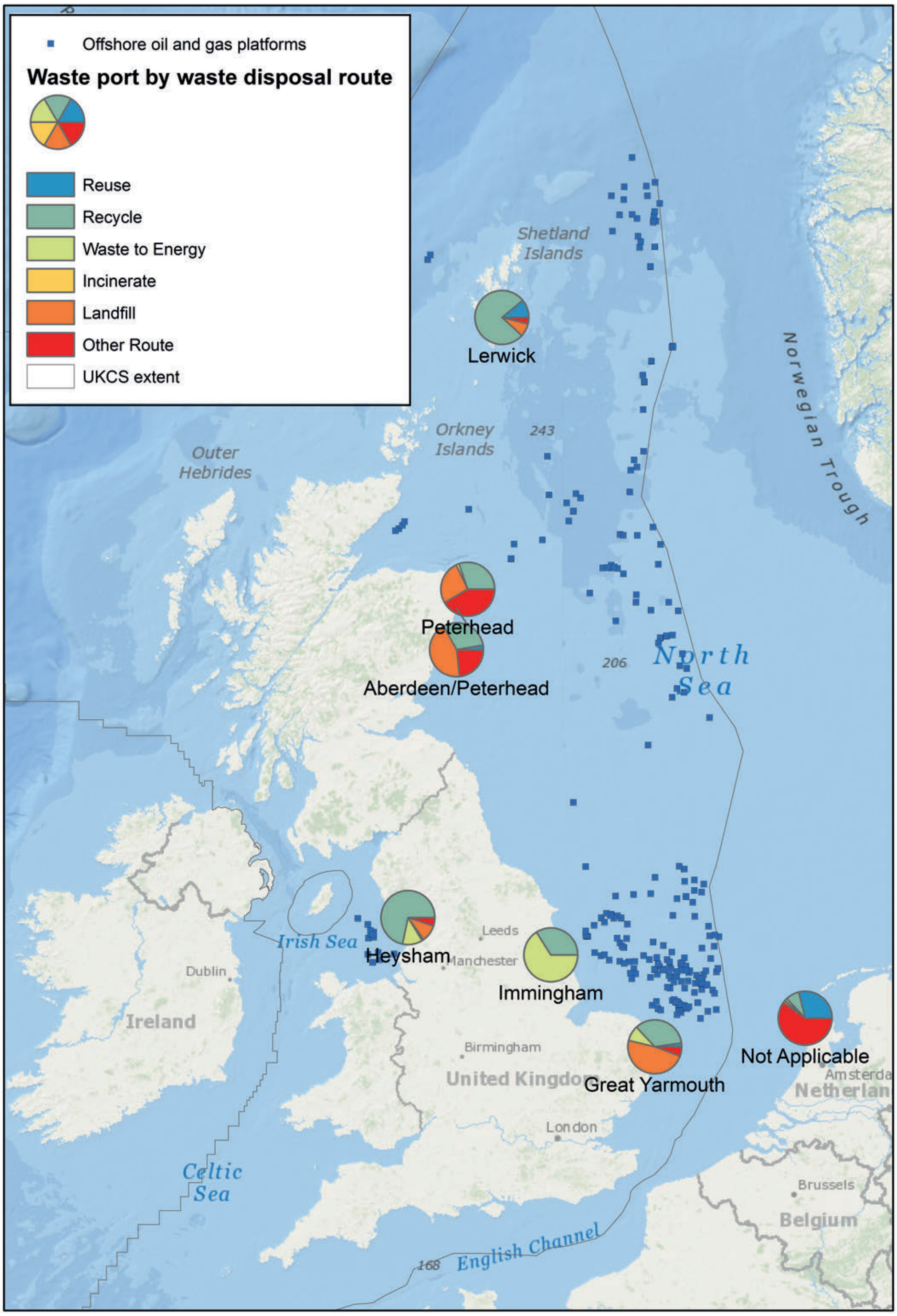


* 'Other' includes any other disposal route such as treatment of aqueous wastes, composting and land spreading

Source: EEMS June 2015

[39] Note: the disposal route for 0.2 per cent of waste was categorised as “not applicable” or was not specified.
[40] Total waste includes drilling, operational and decommissioning wastes.

Figure 20: Operational and Decommissioning Waste Generated in 2014 by Waste Disposal Route[41]



Service Layer Credits: Sources: Esri, GEBCO, NOAA, CHS, CSUMB, National Geographic, DeLorme and NAVTEQ

[41] Not applicable includes waste exported to the Netherlands and other locations that were not specified.

4. Environmental Performance Benchmarking

In 2015, Oil & Gas UK carried out a benchmarking exercise for operators reporting data into the EEMS dataset to gain an overview of their relative environmental performance. This was conducted on an anonymous basis; companies are allocated a letter for each category, to represent their ranking in that context.

A selection of variables from the 2014 EEMS data are benchmarked and/or compared in this analysis, providing insight into cross-industry emissions and discharge trends and an understanding of how patterns are developing over time. There is no single over-riding trend, but by providing each company with individual rankings, the operators can evaluate their own performance in the context of the industry as a whole. Areas of concerning or promising performance can then be identified, with an aim of achieving maximum possible industry-wide emissions efficiency. This work will be taken forward by the Oil & Gas UK Operators Technical Group.

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 type 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 Benchmarking

Oil in Produced Water

Produced water can contain 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 individual monthly samples must contain less than 100 mg/l[42].

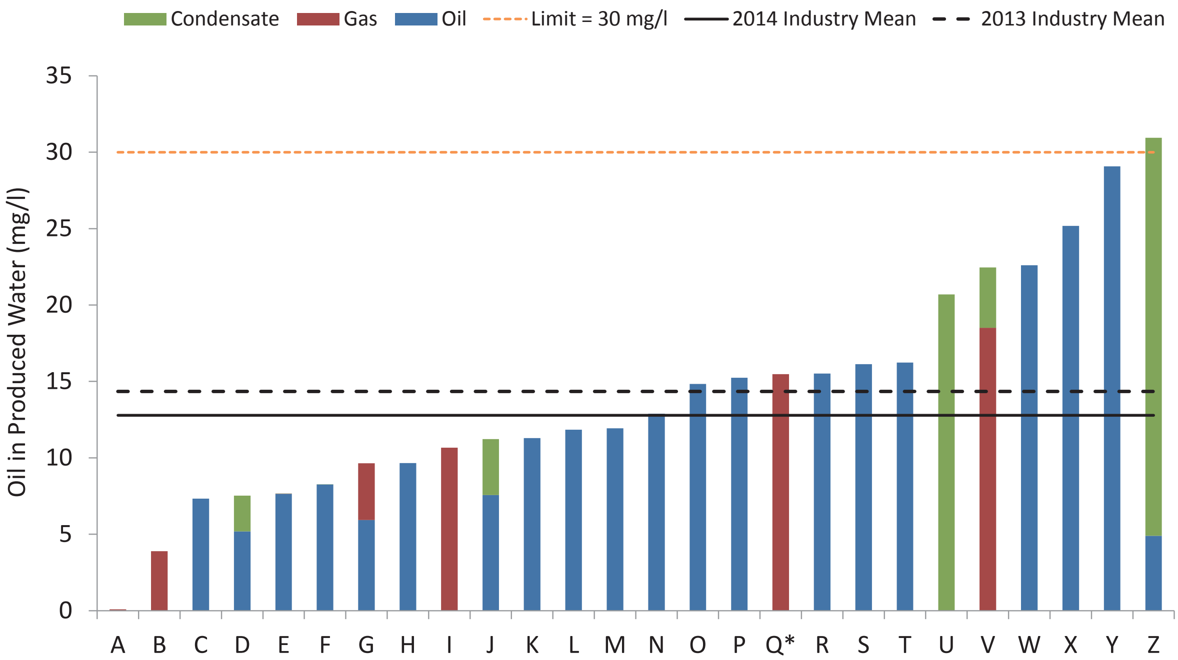
Average oil in water concentration is the result of several factors, which means that those operators with higher values may have more assets, greater production totals and may produce heavier hydrocarbons. This benchmarking therefore provides a general picture of industry oil in water performance but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

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

The mean oil in produced water concentration across the industry in 2014 was 12.8 mg/l. Thirteen of the 27 reporting operators have an average annual concentration lower than this (see Figure 21), while 26 reported concentrations below the OSPAR recommended limit of 30 mg/l.

Operator Z had an average oil in water value of 30.9 mg/l in 2014, which is higher than the OSPAR recommended annual limit. However, none of operator Z's individual monthly samples were higher than 80 mg/l, therefore not exceeding the OSPAR recommended monthly limit.

Figure 21: Concentration of Oil in Produced Water for all Installations run by each Operator by main Hydrocarbon Type in 2014



Operator rankings marked * are those for which one outlier in their dataset was anomalously high and therefore has been removed to reflect the general performance. DECC is aware of this outlier.

Source: EEMS June 2015

Discharged Drill Cuttings

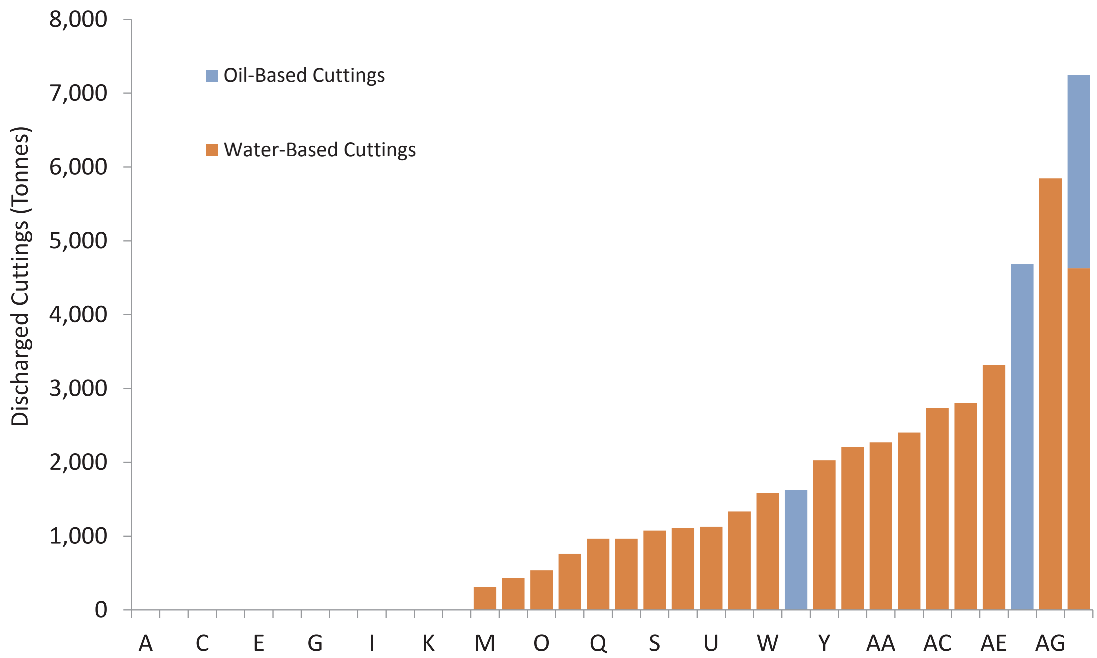
Figure 22 shows the distribution of drill cuttings discharged to sea across the operators on the UKCS in 2014. The amount discharged depends on the length of wells drilled[43]; the longer the well, the more drill cuttings produced. In 2014, just under 90 tonnes of cuttings were discharged per million tonne of hydrocarbons produced, compared with just under 110 tonnes per million tonne produced in 2013. In 2014, almost 280 tonnes of cuttings were discharged per well drilled, which is lower than the 2013 value (340 tonnes per well drilled).

Last year, only three of the 33 operators reporting in this category recorded discharge of oil-based mud cuttings. Discharge of untreated oil-based cuttings is not permitted on the UKCS and so all of these assets have on-board drill cuttings treatment systems to clean any discharged cuttings to the permitted standard (less than one per cent oil content).

An increase from 2013 of 4,000 tonnes of oil-based cuttings discharged 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 2014, or shipped all their cuttings to shore for remediation and disposal.

Figure 22: Cuttings Discharged to Sea per Operator in 2014



Source: EEMS June 2015

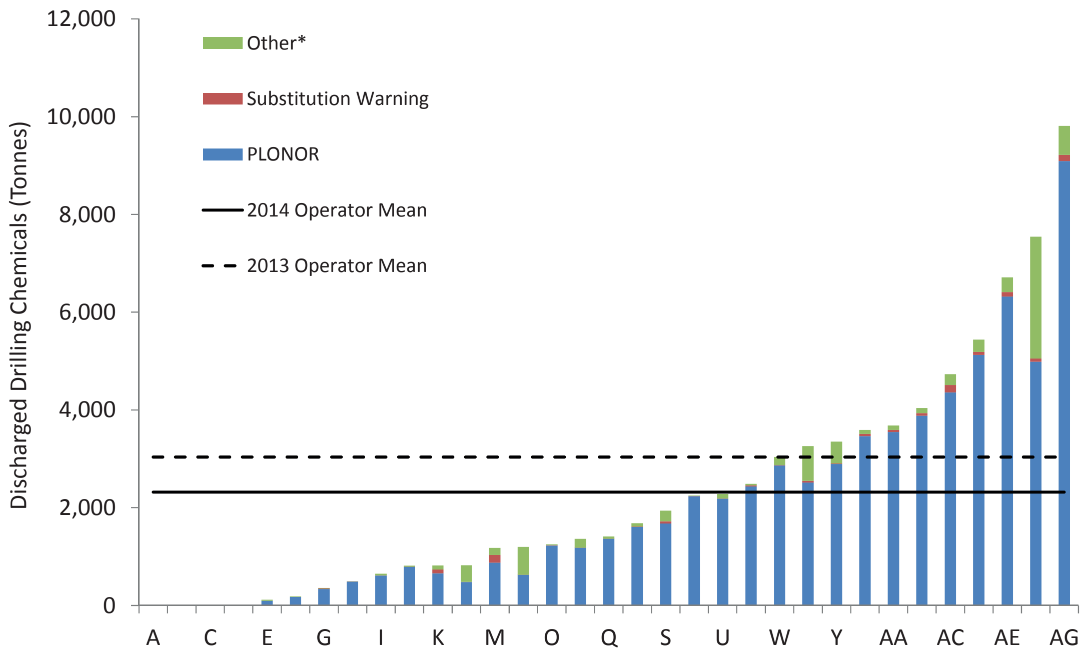
[43] Data on the length of wells drilled were not publically available for 2014 at time of writing.

Drilling Chemicals

Last year, there were three main categories of drilling chemicals discharged to sea, as illustrated in Figure 23. Twenty-one of the 33 reporting operators discharged less than the average of 2,300 tonnes per operator; six reported between 2,300 and 4,000 tonnes; and the remaining six reported larger amounts. The distribution indicates that the majority of drilling on the UKCS in 2014 was completed by a small number of operators with significant amounts of drilling activity. The majority of the discharges were classified as PLONOR (Pose Little Or NO Risk to the environment).

Overall, approximately 450 tonnes of drilling chemicals were discharged per well drilled in 2014, slightly less than in 2013 (590 tonnes per well drilled). Based on the data available, there is no correlation between the number of wells drilled and the mass of drilling chemicals discharged. Use of drilling chemicals is, however, influenced by the type of well drilled, its location, the geology, and the reservoir and product type. It is likely that drilling of longer wells results in more fluids being discharged. It is therefore possible that the operators discharging a larger mass of chemicals drilled the greatest length in 2014.

Figure 23: Drilling Chemicals Discharged to Sea per Operator in 2014



*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 June 2015

Total Offshore Atmospheric Emissions

Atmospheric emissions on the UKCS are permitted by DECC and recorded in EEMS. The total atmospheric emissions for facilities across the UKCS for each operator are shown in Figure 24 overleaf, where the facilities are split by dominant hydrocarbon produced. An additional category is 'mobile installations', which includes rigs, well intervention vessels, and diving and other support vessels. As expected, oil producing installations are the dominant contributors, due to the higher energy input required to produce more complex hydrocarbons.

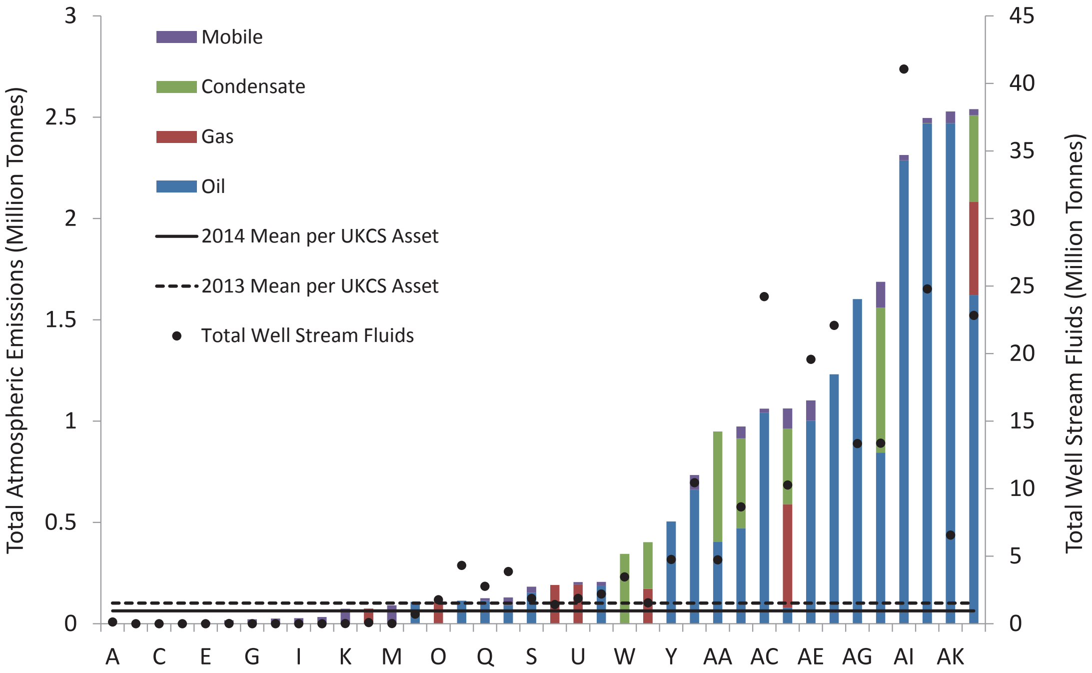
While mobile installations may not produce hydrocarbons, atmospheric emissions are generated from diesel consumption for propulsion and power generation, and from flaring during well testing. There is no clear trend in the graph linking total mass of well stream fluids to total atmospheric emissions. Total emissions are likely to be influenced by the type of hydrocarbon, use of fuel and the reservoir's age.

An average of 63,500 tonnes of total atmospheric emissions were produced per asset on the UKCS in 2014. This is approximately 37 per cent lower than the average of 101,500 tonnes in 2013.

When divided into asset type, the average total atmospheric emissions for fixed installations is 75,400 tonnes and 23,400 tonnes for mobile installations (considerably lower than the 2013 mobile installations' average of 132,500 tonnes). This decrease in average emissions from mobile installations is because fewer atmospheric emissions were reported from fewer installations. There were 42 mobile installations reporting emissions to EEMS in 2014, compared to 53 in 2013. Two of the ten largest mobile contributors of atmospheric emissions in 2013 did not report to EEMS (and were therefore not in use) last year, and four reported atmospheric emissions of less than half the amount. This reduction correlates to a decrease in the number of wells (including sidetracks) drilled between 2013 (164 wells) and 2014 (158)[44].

This benchmarking allows comparison of different operators, but cannot take into account the age, size and number of installations each operator has. An operator will, however, be able to compare the means of these benchmarked variables to their internal data.

Figure 24: Total Atmospheric Emissions per Operator by Hydrocarbon Type in 2014



Source: EEMS June 2015

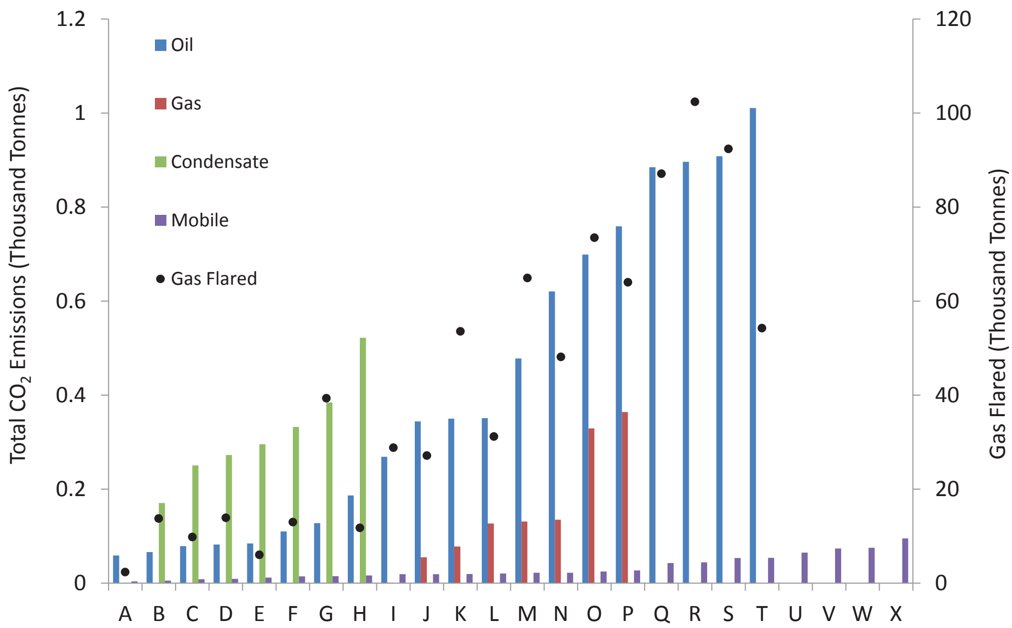
[44] Oil & Gas UK's *Activity Survey 2015* is available to download at www.oilandgasuk.co.uk/activitysurvey

Carbon Dioxide Emissions and Gas Flared

Total offshore CO_2 releases have also been benchmarked separately from total offshore atmospheric emissions. Figure 25 shows that oil requires more energy (more emissions) to produce than condensate and gas.

Gas is flared on the UKCS for maintenance, well testing and for safety reasons, all of which produce atmospheric emissions. When the data are broken down by operator, there is a general link between the mass of gas flared and the mass of CO_2 emitted by oil-producing installations; both increase in Figure 25. Some of those operators may also produce condensate or gas (and contribute to those emissions rankings), and so the comparison is limited. The amount of CO_2 emitted during oil production varies with operational circumstances. Some installations may use cold vent systems rather than flaring for operational and safety reasons. Venting is the controlled release of gases into the atmosphere without burning, which does not produce CO_2 but does produce other gases, such as methane.

Figure 25: Total CO_2 Emissions per Operator by Hydrocarbon Production Type in 2014



Coding refers to each hydrocarbon type separately – for example, the operator ranked A for oil producing installations may be operator X for mobile installations. Gas flared is plotted for the same ranked operator as oil producing installations

Source: EEMS June 2015

Asset Type				
2014	Oil	Condensate	Gas	Mobile
Emissions	8,367,600	2,228,900	1,225,100	764,100
% of total emissions	66%	18%	10%	6%
Average per asset	105,200	66,300	22,900	23,000

5. Accidental Oil and Chemical Releases

5.1 Introduction

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

Offshore hydrocarbon (oil and gas) releases must be reported to the Health and Safety Executive (HSE) and all offshore hydrocarbon and chemical releases, regardless of size, that reach the marine environment must be reported to DECC through the submission of a Petroleum Operations Notice 1 (PON1). PON1 data are published on DECC's website[45] and updated regularly. The following analysis is based on the PON1 dataset 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 2014 and over the past decade.

Further analysis has been carried out to categorise PON1 data from 2010 to 2014 by source and cause of accidental releases, as well as by hazard to the marine environment for the chemical releases.

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; the amount actually released is often lower than that reported.

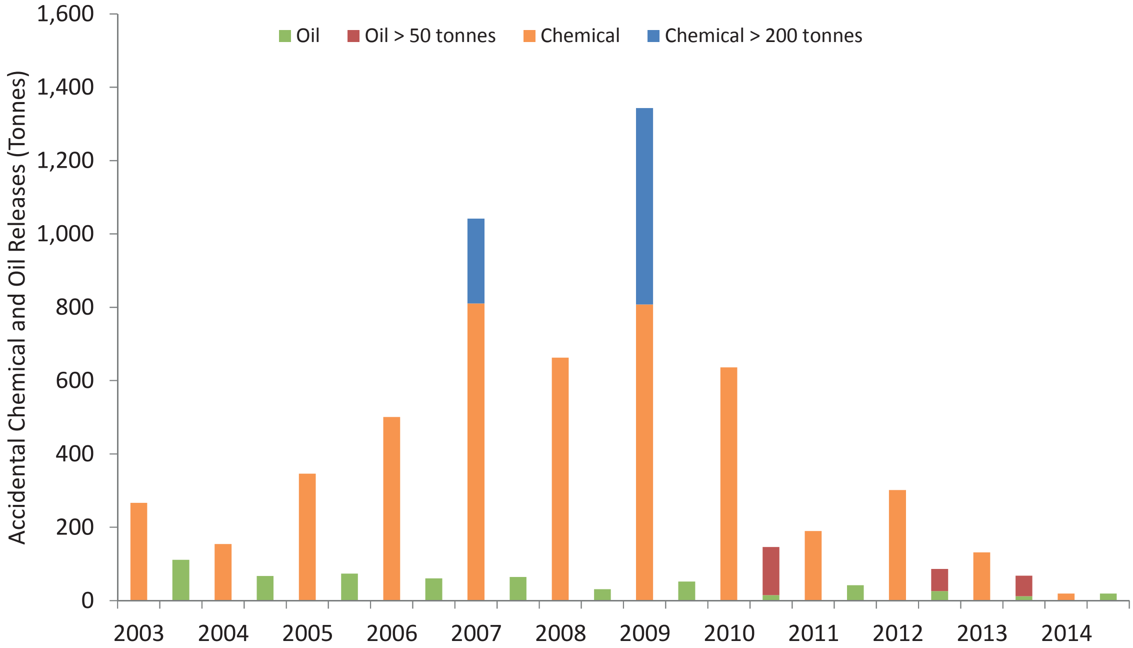
5.2 Overview from 2003 to 2014

There is no clear trend in the amount of chemical and oil releases to the marine environment over the last 11 years, highlighting the sensitivity of these data to single, low incidence, high mass events, as shown in the blue and red peaks in Figure 26 opposite. 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 2010. 2014 had the smallest mass of accidental releases on record, with no individual releases greater than ten tonnes of oil or 200 tonnes of chemicals.

The total amount of oil and chemicals accidentally released on the UKCS in 2014 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.

[45] The DECC PON1 data are available at
http://itportal.decc.gov.uk/eng/fox/pon1/PON1_PUBLICATION_EXTERNAL/viewCurrent

Figure 26: Accidental Chemical and Oil Release Mass



Source: DECC July 2015

5.3 Accidental Oil Releases in Context

In 2014, there were 304 accidental oil releases, from which just under 20 tonnes of oil were released to the marine environment. To put this into context, in the same year, approximately 2,000 tonnes of oil were discharged to sea in produced water, under permit, on the UKCS. This means that accidental oil releases represented less than one per cent of the total oil that entered the marine environment. Furthermore, 74 million tonnes[46] of oil equivalent were produced in 2014, meaning that accidental oil releases represented 0.00003 per cent of total oil production.

Although the number of releases has risen by an additional 15 since 2013, there was a 71 per cent reduction (from 68 tonnes to 20 tonnes) in the amount of oil released. There has been a general decline in the average reported accidental oil release size from 2010 (0.56 tonnes) to 2014 (0.07 tonnes).

The IOGP[47], meanwhile, reports a worldwide total of 6,666 accidental oil releases in 2013, 66 per cent (4,396 incidents) of which were less than one boe. One boe is approximately equivalent to 0.14 tonnes of oil. Comparatively, in 2013, just over 93 per cent (269 incidents) of accidental oil releases on the UKCS were equal to, or less than, 0.14 tonnes. The equivalent values for 2014 are 92 per cent and 280 incidents.

There were 2,270 accidental releases greater than one boe in 2013 in the global IOGP dataset. Seven per cent (159 releases) were from offshore installations, resulting in 0.31 tonnes accidentally released per million tonne of offshore production. In equivalent context, the UKCS reported approximately 0.74 tonnes accidentally released per million tonne of hydrocarbon production in 2013, and 0.23 tonnes in 2014.

[46] This data come from the DECC *Energy Trends* bulletin at www.gov.uk/government/collections/energy-trends
[47] The International Association of Oil & Gas Producers (IOGP) *Environmental Performance Indicators – 2013 Data* is available to download at www.iogp.org/pubs/2013e.pdf

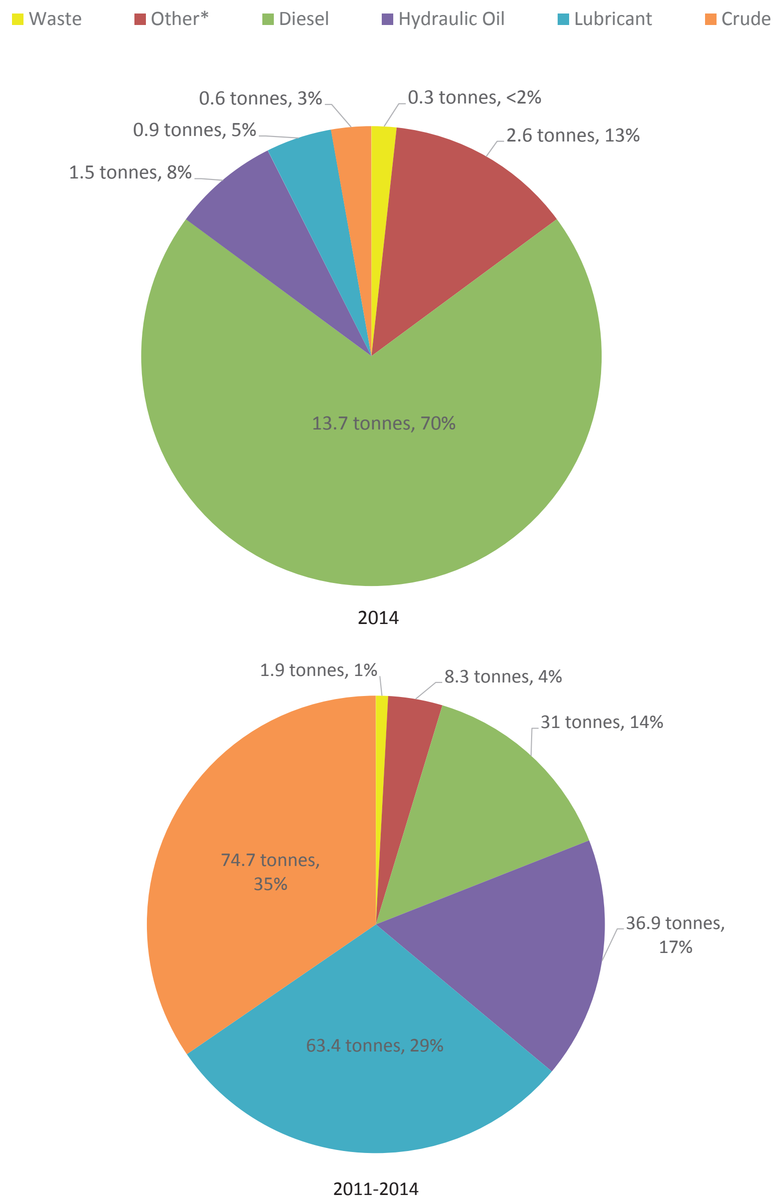
5.4 Accidental Oil Releases Breakdown

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 oil (used for power generation and a lighter oil product) at just under 14 tonnes makes up the majority of the mass of oil accidentally released on the UKCS in 2014 (see Figure 27). Of the number of oil-based products in use or produced in the oil and gas industry, none of the other categories, such as crude oil, hydraulic oil and lubricating oil, contributed more than ten per cent each to the total mass released.

However, over a longer time frame, the most released product by mass between 2011 and 2014 was crude oil, with hydraulic oil, lubricant and diesel also making up a significant proportion of the amount spilled.

Figure 27: Mass of Accidental Oil Releases by Product Type



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

Source: DECC July 2015

The following accidental release analysis is based on a system of categorisation by source and cause developed through discussions with Oil & Gas UK's Environment Forum Operators Technical Group and DECC. There are limited data publically available on the circumstances leading to particular PON1 reports, and so some categories are necessarily broad. The aim was to generate source and cause categories that could be used for both hydrocarbon and chemical releases. Understanding of source and cause trends for past data allows operators to develop plans to target particular operational areas where accidental releases have been more frequent.

Figures 28 and 29 overleaf show the same data broken down in two different ways. There is annual variation in the breakdown of source and cause, which reflects the unplanned nature of the releases. The unknown category encompasses the accidental releases for which no source or cause information was given. Consequently, it is expected that these figures may change in the future. As previously stated, the majority of accidental releases were of small amounts. Figures 28 and 29 highlight the largest incidents over the last five years.

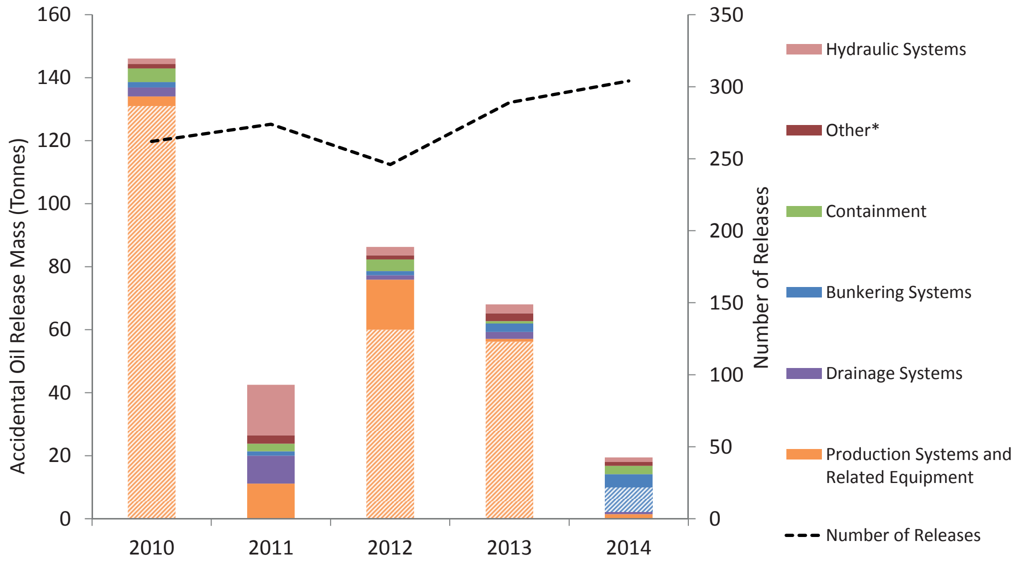
The majority (280 tonnes) of the reported accidental oil releases between 2010 and 2014 came from production systems and related equipment. Figure 28 shows that three releases in those years were unusually large. In 2010, one spill of 131 tonnes of crude from a failed subsea sump pump made up 98 per cent of the releases in this category (represented by the shaded area in the 2010 bar in Figure 28). This accounts for the relatively high proportion of releases coming from production systems and related equipment in that year (and also for the similar trend in structural failure in Figure 29). Similarly, in 2012, the majority of the reported accidental releases in the production systems and related equipment category came from one incident where failure of a subsea flow termination assembly caused 60 tonnes of crude to be released. These masses are the worst case estimations for each incident and so the actual amount released is likely to be less.

In 2014, there were no accidental releases of oil greater than eight tonnes. The largest release in 2014 was of 7.7 tonnes of diesel due to a split bunkering hose. This contributes to the bunkering systems source category and the structural failure cause category.

The most common causes (Figure 29) of accidental releases between 2010 and 2014 were structural failure (72 per cent, 260 tonnes) and human error (20 per cent, 72 tonnes). The structural failure category includes small operational leaks, seeps and weeps, as well as those reports for which little information beyond 'failure' or 'leak' is provided. Very few of these represent barrier breaches and the larger releases outlined here are the exception.

The relatively large (83 per cent) contribution of human error to the accidental releases in 2013 was dominated by one release of just over 56 tonnes, due to an incorrectly routed lube oil drainage system that resulted in this release to sea over several years (contributing to the production systems and related equipment section of Figure 28). This fault was rectified and reported in 2013, and so the mass quoted is cumulative rather than specific to a single year and is also the worst case. The similarly large proportion of human error in 2011 is due to one release of diesel associated with a drainage valve being left open after maintenance, making up approximately half of this category.

Figure 28: Accidental Oil Release Mass by Source

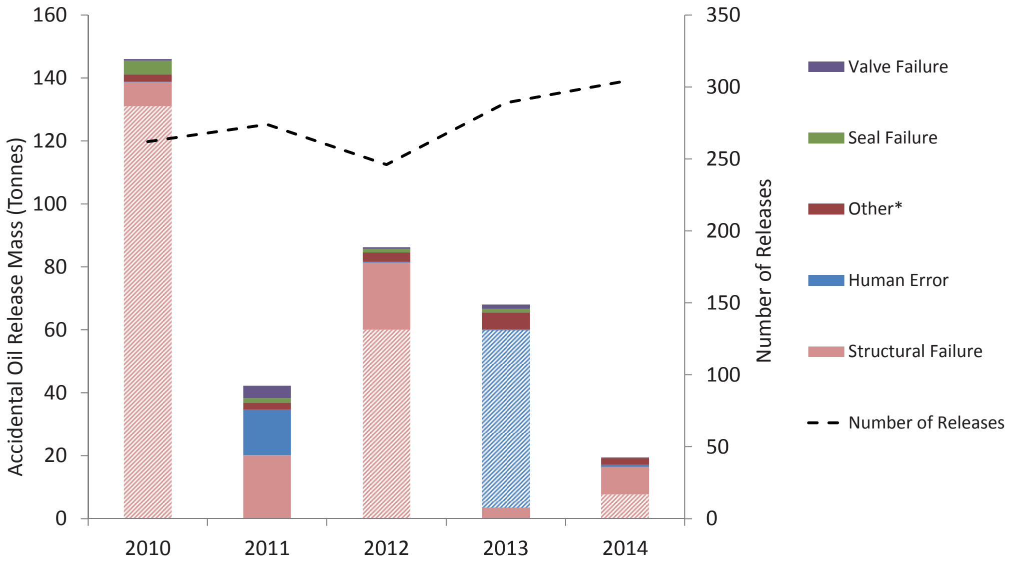


*Other includes releases from firefighting systems, flare systems, pipework infrastructure, deck washings and unidentified sheen, as well as those releases for which no source is identified.

Source: DECC July 2015

Shading highlights single large releases in that particular category.

Figure 29: Accidental Oil Release Mass by Cause



*Other includes releases caused by flange issues, blockage, maintenance, drop out, run off, fitting failure, mechanical failure, overflow and those releases for which no cause is identified.

Source: DECC July 2015

Shading highlights single large releases in that particular category.

5.5 Accidental Chemical Releases in Context

In 2014, approximately 110 tonnes of chemicals were accidentally released in 207 incidents on the UKCS. There was a reduction of 20 tonnes in the mass of chemicals released since 2013, but only two fewer reported incidents. In 2014, approximately 334,100 tonnes of chemicals were used on the UKCS. Accidental releases therefore accounted for 0.03 per cent of the total mass of chemicals used in 2014. There was a large decrease in the average reported accidental chemical release size between 2010 (3.98 tonnes) and 2014 (0.61 tonnes).

5.6 Accidental Chemical Releases Breakdown

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[48] were used to produce the classifications detailed below.

Figure 30: Hazard Ranking Categories for the Breakdown of Accidental Chemical Releases

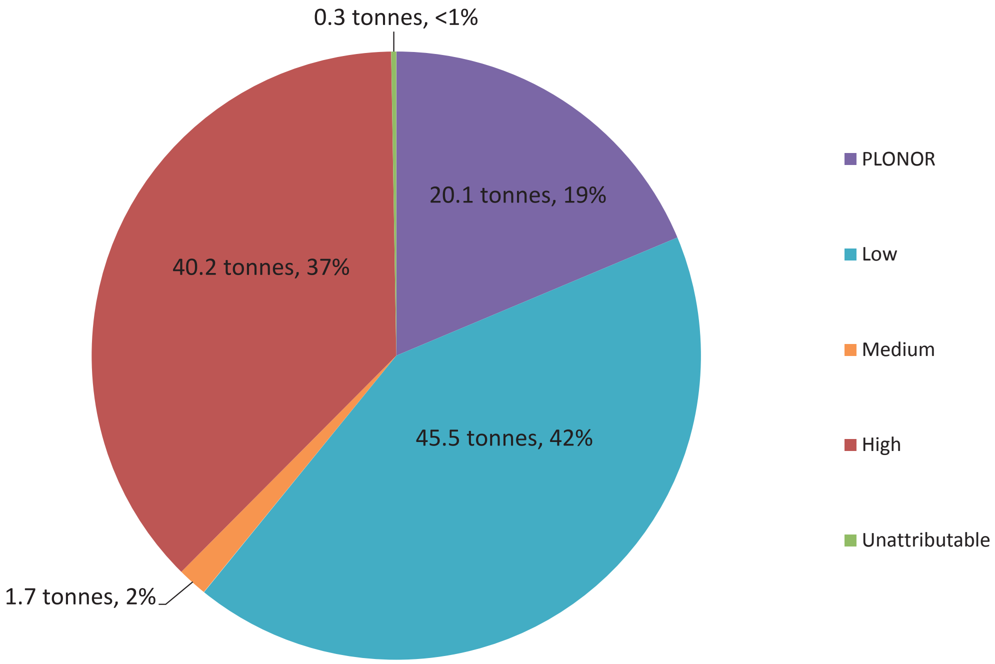
Hazard Ranking	Components
PLONOR	The PLONOR category includes all those products for which PON1s were submitted that have been assigned PLONOR (Pose Little Or NO Risk) status by DECC.
Low	The Low Hazard category includes OCNS groups D and E as the lowest ecotoxicity groupings. This excludes products 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 that are either not categorised by OCNS or for which sufficient description is not given, and therefore they cannot be categorised in this model.

[48] The Centre for Environment, Fisheries and Aquaculture (CEFAS) Offshore Chemical Notification Scheme (OCNS) chemical classifications are available at www.cefas.co.uk/cefas-data-hub/offshore-chemical-notification-scheme/hazard-assessment

In 2014, approximately 61 per cent (66 tonnes) of all accidental chemical releases on the UKCS fell into the low and PLONOR hazard categories from 170 incidents (see Figure 31 below). Nine incidents and 37 per cent (40 tonnes) of the mass of chemicals accidentally released fell into the higher hazard category. This demonstrates that high hazard accidental releases were less common than low hazard and PLONOR releases in 2014, and tended to be larger, singular events.

The majority (95 per cent) of these high hazard releases in 2014 is attributable to one spill of approximately 38 tonnes of Oceanic HW540 2, a water-based hydraulic fluid that holds a SUB 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 substances, which give it its high hazard category status.

Figure 31: Total Mass of Chemical PON1s Reported in 2014 by Hazard Category



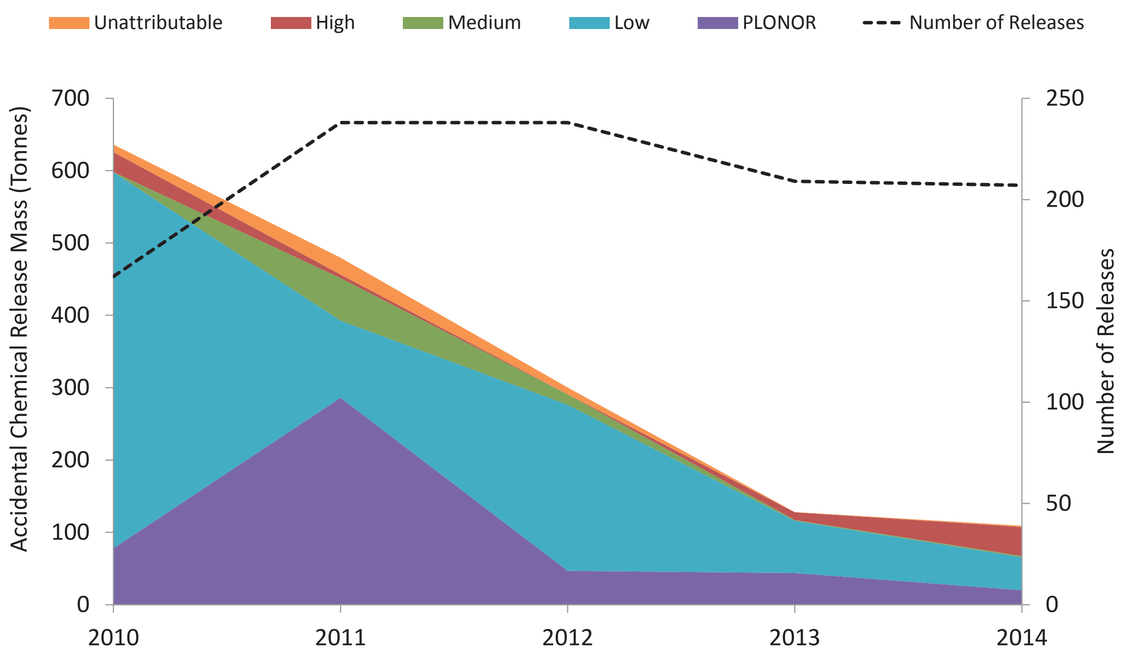
Please note: this graph has been created from raw data and percentages have been rounded accordingly.

Source: DECC July 2015

There were no large releases of high hazard chemicals between 2010 and 2013, as shown in Figure 32. The 2014 trend of high hazard releases being less common and larger, in general, than low hazard and PLONOR releases is also true of these years. When analysed by source and cause, most high hazard releases over the last few years fall into the production systems and related equipment category, in line with the trend for all hazard types.

From 2010 to 2014, 1,650 tonnes of chemicals were reported in PON1s on the UKCS, representing a total of 1,054 incidents. PLONOR and low hazard category chemicals make up the majority (1,450 tonnes) of the mass released and the number of incidents in this longer time frame. High and medium hazard category chemicals contributed approximately five per cent each by mass, with the remaining mass falling into the unattributable category. There has been an 83 per cent (more than 500 tonnes) decrease in the mass of chemicals accidentally released between 2010 and 2014, with a 28 per cent net increase in the number of incidents (from 162 to 207). Therefore, a similar number of releases have been reported, but those releases were of smaller amounts.

Figure 32: Mass of Accidental Chemical Releases by Hazard Category and with Number of Releases



Source: DECC July 2015

The accidental chemical releases from 2010 to 2014 are also categorised by source and cause. Figures 33 and 34 opposite show 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 the releases. The unknown category encompasses the accidental releases for which no source or cause information was given. Consequently, it is expected that these figures may change in the future.

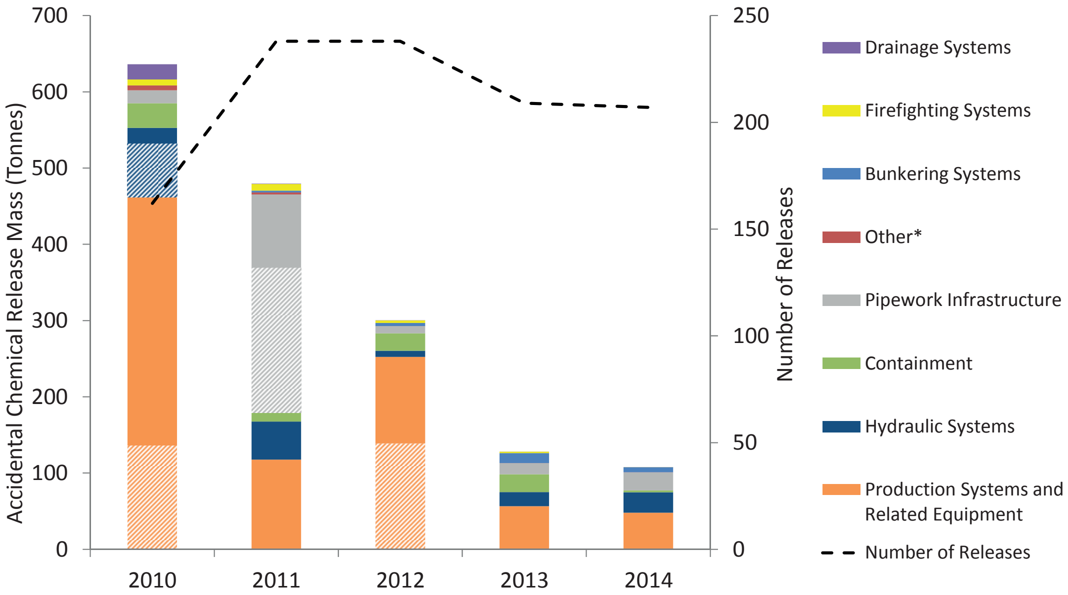
Between 2010 and 2014, production systems and related equipment contributed the majority (940 tonnes) of all accidental chemical releases, with hydraulic systems and pipework infrastructure accounting for twelve (190 tonnes) and 21 per cent (350 tonnes), respectively (as shown in Figure 33). The 2010 production systems and related equipment proportion (73 per cent of the total 2010 mass) is notable as it is dominated by eight releases of more than ten tonnes each. The largest of these is a release of 136 tonnes of a low hazard production control fluid due to 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.

Accidental releases from hydraulic systems made up 14 per cent (90 tonnes) of the total in 2010, and the largest release in this category was of a worst case estimate of almost 71 tonnes of low hazard production control fluid due to an intermittent leak from a subsea hydraulic valve. In 2011, the majority of accidental releases were from pipework infrastructure, dominated by one incident where an estimated worst case amount of 190 tonnes of methanol were accidentally released due to the failure of a subsea pipeline during pressure testing. Methanol is categorised as PLONOR. The 2012 production systems and related equipment bar is made up of 112 incidents, 21 of which were greater than one tonne and are all PLONOR, low or medium hazard chemicals. The largest was a release of 139 tonnes of low hazard water-based drilling fluid from the wellbore.

2013 and 2014 data show similar trends in the breakdown of sources of accidental releases, and the largest in those two years was the production systems and related equipment 38-tonne release of hydraulic fluid, as explained on p46.

The most common cause (Figure 34) of accidental chemical releases between 2010 and 2014 was structural failure, making up almost half (780 tonnes) of the mass released. Valve failure and seal failure make up 15 (250 tonnes) and 10 per cent (170 tonnes), respectively. The dominance of structural failure is similar to that shown in the accidental oil release trends and again includes those incidents for which limited information is provided.

Figure 33: Accidental Chemical Release Mass by Source

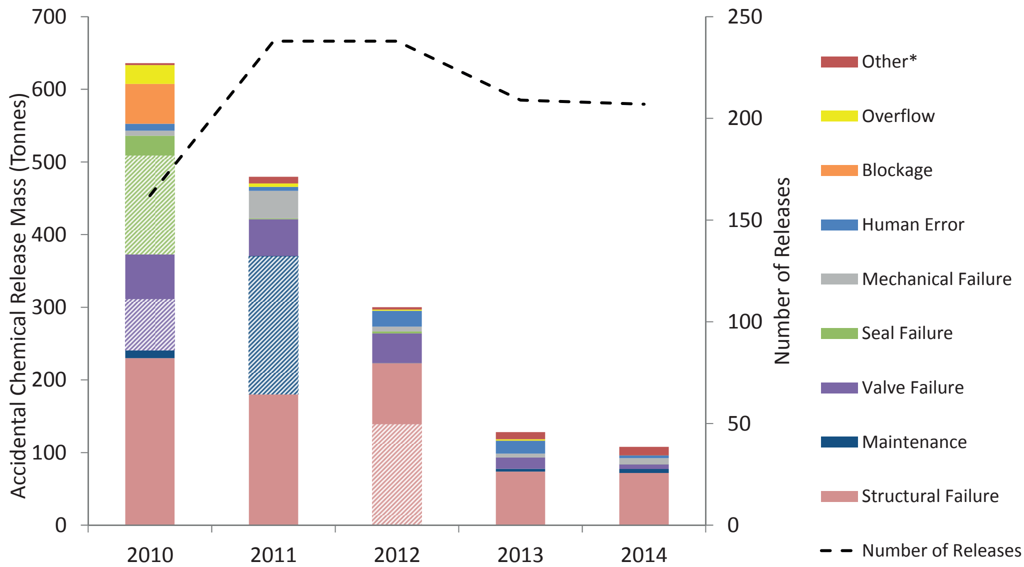


*Other includes releases from flare systems, deck washings and those releases for which no source is identified.

Shading highlights single large releases in that particular category.

Source: DECC July 2015

Figure 34: Accidental Chemical Release Mass by Cause



*Other includes releases caused by flange issues, drop out, run off, fitting failure and those releases for which no cause is identified.

Shading highlights single large releases in that particular category.

Source: DECC July 2015

5.7 Accidental Release Mitigation

There are several industry initiatives aimed at decreasing accidental release incidences on the UKCS. Oil & Gas UK hosts an Oil Spill Response Forum that was created in 2011 to continue the work of the Oil Spill Prevention and Response Advisory Group (OSPRAG)[49]. This Forum encompasses the following work groups: the Oil Spill Response Technical Group; the Environmental Sensitivities Technical Group and a Modelling Technical Group. The aim is to maintain a robust and sustainable oil spill response capability for upstream operations on the UKCS (see Section 6 for more information on these groups).

The Step Change in Safety (SCiS) Asset Integrity Steering Group also governs three work groups that aim to improve hydrocarbon release (HCR) performance. First, the HCR Improvement and Implementation Work Group is using peer assessment to develop and share good practice within the industry. This group asks its member companies qualitative questions about the content and implementation of HCR-reduction plans. By the end of 2015, the group will have assessed 12 operating companies and intends to progress onto major contractor companies and drilling in 2016.

Secondly, the Sharing and Learning Work Group focuses on using lessons learnt from past HCR and major accidents to develop more engaging safety moments. Safety moments are opportunities to share experiences, usually at the beginning of meetings, in an effort to highlight an incident that others can learn from. Thirdly, the Major Accident Hazard Understanding Work Group is developing gap analysis tools to identify training needs to enable workers to manage Major Accident Hazards, no matter what their role, onshore and offshore.

A fourth SCiS initiative is the Joined-up Thinking campaign[50], which provides learning packs about previous HCR incidents in an attempt to prevent future releases.

[49] OSPRAG was established to co-ordinate the UK's response to the issues arising from the 2010 Deepwater Horizon incident in the Gulf of Mexico.

[50] More information on the Joined Up Thinking campaign is available at www.stepchangeinsafety.net/safety-resources/joined-up-thinking

6. Significant Issues and Activities

6.1 Improving Efficiency in Environmental Management

Improving efficiency in oil and gas production on the UKCS is an area of important focus for the industry. Many companies have taken on the challenge internally and industry initiatives, such as Oil & Gas UK's Efficiency Task Force, are highlighting good ideas and encouraging their implementation. From 2014 to 2015, Oil & Gas UK worked with its members to improve efficiency in the environmental management of exploration and production operations by looking to standardise environmental management practices; working together to reduce duplication and provide evidence to consultations jointly; minimising the administrative burden of new legislation; and mitigating the impacts of new legislation by working closely with key stakeholders in the UK Government and from the EU.

The work has aimed to improve efficiency in environmental management processes and at the same time maintain current levels of environmental protection, demonstrated by the continued decline in emissions and discharges by the industry. Further efficiency improvements are achievable. This requires, however, continued effort by industry and the regulators and a proportional approach to environmental management based on the level of environmental risk posed. Such an approach would allow effort and resources to be sensibly focused on the areas of greatest risk and potentially significant impact.

This chapter describes the key efficiency improvements and ways in which Oil & Gas UK has been working to achieve these with members through existing forums and work groups.

Mitigating the Impact of New Legislation

The UK offshore oil and gas industry is controlled and regulated through a broad range of national and international legislation that governs how it operates in the shared marine environment and as part of the unique North Sea ecosystem.

The legislation requires industry to understand the environment it is operating in so that potential impacts can be fully assessed. This understanding comes through the evidence gathered from environmental surveys, research studies and from the review of academic publications. The same evidence is used to assess the impact that new legislation might have on the industry. Oil & Gas UK continues to review new environmental legislation and press for regulatory reform where there is no clear environmental benefit, while working with members and regulators to increase understanding of and to facilitate efficient implementation of new regulatory requirements.

In 2015, Oil & Gas UK developed responses for a number of formal consultation requests from government. These include responses on the introduction of new marine protected areas such as Special Protection Areas, Marine Protected Areas, Marine Conservation Zones and Special Areas of Conservation offshore; the UK programme of measures under the EU Marine Strategy Framework Directive; the Scottish Environment Protection Agency (SEPA) enforcement policy; and amendments to existing requirements such as to the Seaward Area Production Licences.

a. The Hydrocarbons BREF

The EC Environment Directorate-General (DG ENVI) has proposed the development of a Best Available Techniques (BAT) Reference document or BREF on hydrocarbon exploration and extraction. The overall objective is to support the Commission in identifying the Best Available Techniques for risk and impact management for the hydrocarbons exploration and extraction sector. This is intended to assist licensing and permitting by Competent Authorities of Member States. Oil & Gas UK continues to engage with the EC, industry and government to ensure that the BREF does not have any unintended consequences for the environmental and safety regimes already in place on the UKCS.

b. The Implementation of the EU Offshore Safety Directive

On 28 June 2013, the EC published the Directive 2013/30/EU on the safety of European offshore oil and gas operations. The objective is to set minimum requirements to reduce as far as possible the occurrence of major accidents related to operations and to limit their consequences. The Directive was transposed into UK law on 19 July 2015.

The Directive has placed additional requirements on oil and gas companies to include further details in their Oil Pollution Emergency Plans (OPEP) on oil spill response equipment, oil spill response effectiveness, alignment with national plans and monitoring. The Directive also requires consideration of the potential environmental consequence of a major accident event to be included in the offshore Safety Case and additional demonstration of financial, technical, safety and environmental management capability at the time of licence application.

Oil & Gas UK has been actively working with its members in the past year to understand the new requirements and provide supporting materials to help operators meet their obligations, aimed at adopting a standardised approach and minimising any additional administrative burden. Examples in 2015 include *Guidelines on Oil Spill Response Effectiveness in UK Waters*[51] and technical notes on financial responsibility for production assets and environmental critical elements.

c. The Large Combustion Plant BREF

The Industrial Emissions Directive (2010/75/EU) is implemented through the Offshore Combustion Installations (Pollution Prevention and Control) Regulations 2013 and is applicable to combustion installations of 50 Mega Watts thermal (MWth) or over. The Directive requires the development of BREF documents.

The Large Combustion Plant BREF has been largely drafted in 2015 and sets BAT Associated Emission Limits (AELs) for NO_x and CO and suggests that Dry Low NO_x (DLN)[52] is the BAT for offshore turbines. Application of the original BREF recommendations in UK permits would have required refit or renewal of a significant number of turbines on the UKCS, with the potential for forcing early cessation of production for some platforms and impacting the industry's ability to maximise economic recovery on the UKCS.

[51] The *Guidelines on Oil Spill Response Effectiveness in UK Waters* are available to download at http://oilandgasuk.co.uk/product/the-oil-spill-response-effectiveness-in-uk-waters/

[52] A technical note on DLNs is available to download at http://bit.ly/1MwT4jI

In 2015, Oil & Gas UK worked closely with IOGP, DECC and the Department for Environment, Food & Rural Affairs on this issue, successfully securing a revision of the BAT AELs. This included developing evidence that compared the cost of implementing the BREF with the forecast air quality benefits. This cost-benefit analysis demonstrated that the expenditure associated with compliance with the BREF significantly outweighed the forecast environmental and societal benefits. It is believed that approximately two turbines on one installation will be exposed at the revised emission limit for NO_x by the time the new AELs come into force. Oil & Gas UK continues to work with DECC to understand its interpretation of the relevant text within the BREF as well as its plans for implementation.

The proposed BAT DLN, meanwhile, is only effective at reducing emissions when the load on the turbine is high. The load usage of turbines on offshore platforms is highly variable and, for safety reasons, a redundant extra load capacity is maintained. Therefore, significant reductions in emissions using DLN are not achievable in most operating circumstances.

Similarly, Oil & Gas UK worked with IOGP and DECC to put forward the industry's position on the proposed Medium Combustion Plant Directive. The Directive included Emissions Limit Values (ELVs) for NO_x and CO that were unachievable for the UKCS due to the operational reasons highlighted above. The proposed ELVs had the potential to force early decommissioning of numerous installations on the UKCS. At the time of writing, it appears that the final text of the Directive is likely to include an exemption for offshore platforms.

Increasing Standardisation

Standardisation of approaches across industry improves efficiency. Oil & Gas UK has been working with its members to increase standardisation in environmental management including:

- Generating seabed survey strategies that aim to encourage standardisation while gaining greater understanding of the effect oil and gas activity has on the seabed. A standardised approach will also promote sharing of data and survey platforms.

- Working in co-operation with regulators on new guidance and requirements to improve consistency, such as the Energy Saving Opportunity Scheme guidance, the oil spill modelling for OPEPs and improvements to the classification of accidental releases.

- Working with the regulators on standardising and simplifying approaches to chemical permitting to reduce the administrative burden of the process.

- Publication of industry guidelines that aim to improve knowledge and promote consistent approaches. These include fisheries liaison guidelines, comparative assessment in decommissioning programme guidelines and a suite of eight oil spill response implementation guides in the oil spill response toolkit[53].

[53] These guidelines are available to download at www.oilandgasuk.co.uk/publicationssearch.cfm

Collaborative Projects
Oil & Gas UK has facilitated several collaborative and multi-stakeholder studies in 2015 to continue to improve industry's knowledge of the marine environment. 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. These studies include:

- **Monitoring Capability Assessment** – this study continues to gather information on the capability of the UK industry and wider scientific community to monitor an offshore accidental oil release event on the UKCS. Monitoring of the marine environment during an incident is important for assessing potential impacts and is used to inform operational response decisions.

- **Oil Sensitivity Index (OSI) for Seabirds** – the index that describes seabird sensitivities to accidental oil releases offshore is being updated to take into account the wealth of new survey data that have been collected and to take the opportunity to review the method and factors used in calculating the OSI. A full report and new Geographic Information System shapefile tool for industry is expected early in 2016.

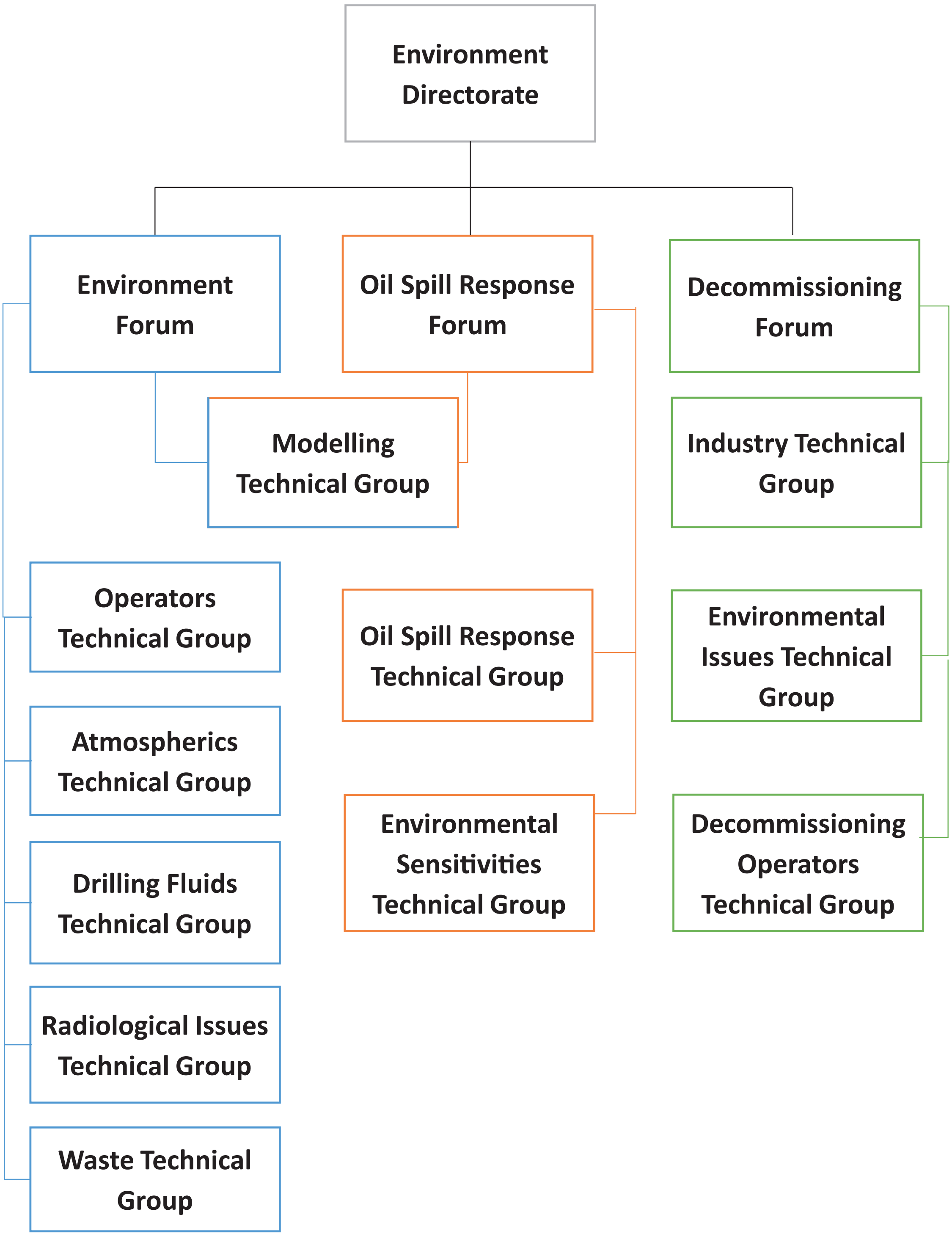
- **Environmental Legislation Website** – the Environmental Legislation Website[54] is an online resource for members that provides information on the statutory requirements for offshore and onshore upstream oil and gas activities. The website has been updated and modernised recently so that visitors can more easily search the site and find key legislation. The new website was launched in early September 2015.

[54] The Environmental Legislation website can be found at http://oilandgasukenvironmentallegislation.co.uk

6.2 Forums and Work Groups

The work areas described in Section 6.1 have all been carried out through engagement with industry and in Oil & Gas UK's forums and work groups.

Figure 35: Oil & Gas UK's Environment Directorate Forum and Technical Group Structure



The Environment Forum

The Environment Forum and its technical groups help members to manage environmental issues through the exchange of specialist knowledge and operational experience. The forum also provides an opportunity to discuss and facilitate the development of Oil & Gas UK strategies and provides a platform for member company engagement.

Co-operative working and use of resources are promoted within the forum between companies and other North Sea Trade Associations. This year, much of the effort has been focused on improving standardisation and supporting pan-industry projects. Topics discussed include the EU ETS, transfer of environmental permits and emissions reporting. The objectives and main areas of work within the technical groups that support the Environment Forum are described below:

- **Atmospherics Technical Group** – this group was established to address atmospheric emission issues arising from exploration, production, decommissioning and associated supply chain activities. This year, the group worked on the implementation of the EU ETS, the EU Energy Efficiency Directive and the Energy Savings Opportunity Scheme Regulations.

- **Drilling Fluids Technical Group** – the primary purpose is to facilitate member discussion that enables the safe and environmentally conscious use of all drilling fluids on the UKCS.

- **Operators Technical Group** – this group has focused on improving the standardisation of the environmental management regime, supporting collaborative projects and understanding the requirements of the EU Offshore Safety Directive implementation in the UK.

- **Modelling Technical Group** – discussion on all aspects of modelling within industry is facilitated through this group. It is currently providing support to DECC to align oil spill modelling requirements for the OPEPs, Financial Responsibility and Environmental Impact Assessments.

- **Radiological Issues Technical Group (RIG)** – this group helps the UK oil and gas industry develop a common approach, and supporting methodologies to meet its monitoring requirements under The Radioactive Substances Act (RSA) 1993. This year, the group engaged with and responded to a consultation with the regulator (SEPA) on the new charging scheme and enforcement measures.

- **Waste Technical Group** – this has the objective to identify, understand and, where necessary, propose actions to resolve current and emerging issues associated with handling and disposal of wastes arising from the UK offshore oil and gas industry.

Oil Spill Response Forum

The Oil Spill Response Forum and its technical groups provide the opportunity for members to be at the heart of developing and maintaining an effective, robust and sustainable oil spill response capability for upstream operations on the UKCS. The Oil Spill Response Forum was created to continue the work of the Oil Spill Prevention and Response Advisory Group (OSPRAG); a group established to co-ordinate the UK's response to the issues arising from the 2010 Deepwater Horizon incident in the Gulf of Mexico.

The objectives and main areas of work of the two technical groups that support the Oil Spill Response Forum are described below:

- **Oil Spill Response Technical Group** – this was established to facilitate the development and maintenance of an effective, robust and sustainable oil spill response capability for upstream operations on the UKCS. This year, the group has focused on developing an oil spill response toolkit and the monitoring capability assessment.

- **Environment Sensitivities Technical Group** – this group explores environmental sensitivities associated with oil spills on the UKCS. In 2015, it has focused on the seabirds OSI and coastal sensitivity mapping of the Scottish coastline.

Decommissioning Forum and Decommissioning Sub-Committee

The Decommissioning Forum was launched in 2012 to provide an opportunity for members to engage with Oil & Gas UK on decommissioning issues. The group looks at regulatory, operational implementation issues, the decommissioning market and stakeholder engagement.

The Decommissioning Sub-Committee was established on 31 March 2014. The main objectives are to provide strategic direction and oversight of Oil & Gas UK's decommissioning activities. This year, the sub-committee has focused on developing a decommissioning strategy and working with the Oil and Gas Authority to establish a single decommissioning forum as envisaged in the Wood Review[55]. The objectives of the sub-committee are to:

- Provide the forum for facilitating communication and collaboration with regulators and across the stakeholder community to develop a common understanding of the process of decommissioning and how it can be optimised, based off a single integrated Decommissioning Strategy for the UK industry.

- Work with industry and regulators on the timing of decommissioning key assets such that economic recovery from the North Sea is maximised.

- Promote fit-for-purpose decommissioning scope to be based on a robust evidence-base that achieves the optimum balance of safety, environmental, social and economic impact, as well as technical feasibility.

- Seek to promote efficient and effective execution within a competitive market by encouraging challenge and innovation. Recognising efficient execution requires operators, the supply chain and regulators to work together and is achieved at the lowest cost by integration of late life operations and decommissioning.

- Work with and promote the UK supply chain to ensure that they are positioned to be the delivery provider for safe, cost-efficient decommissioning programmes at home and abroad.

[55] The *Wood Report* is available to download at www.gov.uk/government/groups/wood-review-implementation-team

7. Glossary

Anthropogenic	Relating to, stemming from, or a direct result of human activity
BAT AELs	Best Available Techniques Associated Emissions Levels
Becquerel	The International System of Units' derived unit of radioactivity. One Becquerel equals one radioactive disintegration per second.
Biocides	Chemicals that are added to a fluid to kill bacteria
Bio-accumulation	The uptake of organic compounds by biological organisms from either water or food, at a higher concentration than in the surrounding environment.
boe	Barrels of Oil Equivalent
CCS	Carbon Capture and Storage
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CFCs	Chlorofluorocarbons
CH_4	Methane
CHARM	Chemical Hazard and Risk Management – a model used by CEFAS to rank chemicals according to hazard quotient.
CO	Carbon monoxide
CO_2	Carbon dioxide
Co-precipitation	Precipitation is the creation of a solid from a liquid, which occurs naturally for certain chemicals under suitable conditions. Co-precipitation is when additional substances are pulled into the solid which would not form a solid alone.
CRC	Carbon Reduction Commitment
DECC	Department of Energy & Climate Change
Dispersant	A chemical used to help break up a solid or liquid into another substance
Ecosystem	A dynamic system of plant, animal and micro-organism communities and their non-living environment interacting as a functional unit
EEMS	Environment and Emissions Monitoring Systems
ESAS	European Seabirds At Sea
ESOS	Energy Savings Opportunity Scheme
EU ETS	EU Emissions Trading Scheme
EUAs	European Union Allowances
GC-FID	Gas Chromatography - Flame Ionisation Detector
GHGs	Greenhouse Gases
HCR	Hydrocarbon Release
HSE	Health and Safety Executive
IED	Industrial Emissions Directive
IR	Infrared
LCP BREF	Large Combustion Plant Best Available Techniques Reference Document
MARPOL	The shorthand for the International Convention for the Prevention of Pollution from Ships

N_2O	Nitrogen dioxide
NCS	Norwegian Continental Shelf
NORM	Normally Occurring Radioactive Materials
NO_x	Nitrogen oxides
OCNS	Offshore Chemical Notification Scheme
OSPAR	The Oslo and Paris Convention for the protection of the marine environment of the North East Atlantic.
OSPRAG	Oil Spill Prevention and Response Advisory Group
PEC	Predicted Environmental Concentration – the expected concentration of a material in the environment, taking into account the amount initially present in the environment, its distribution and rates of natural or forced degradation and removal.
PLONOR	Pose Little Or NO Risk – used by OSPAR to classify substances used and discharged offshore
PNEC	Predicted No Effect Concentration – the concentration below which exposure to a substance is not expected to adversely impact the surrounding environment.
PON1	Petroleum Operations Notice 1
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.
Reinjection	The process by which some waste streams, such as produced water and drill cuttings, can be pumped back into the reservoir or to deep rock strata, respectively. Not all installations have this capability and suitable geology is required.
RIG	Radiological Issues Group
RSA	The Radioactive Substances Act 1993
SCiS	Step Change in Safety
SO_x	Sulphur oxides
Tank Washings	Liquid remaining in tanks after they have been emptied and cleaned, usually made up of some of the original content mixed with the fluid used for cleaning.
UHCs	Unburned hydrocarbons
UKCS	UK Continental Shelf
VOC	Volatile Organic Compound
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); and the total fuel gas use and gas flared.

Notes

Notes

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