OGUK’s vision is to ensure the UK Continental Shelf becomes the most attractive mature oil and gas province in the world with which to do business.

Read all our industry reports at www.oilandgasuk.co.uk/publications
Disclaimer
The UK Oil and Gas Industry Association Limited (trading as OGUK) 2019
OGUK uses reasonable efforts to ensure that the materials and information contained in the report are current and accurate, as part of the development for this report, both the EEMS and the PON 1 data used was updated for previous years, so in the event comparisons are made there may be differences to previous reports. These differences occur as EEMS returns are sometimes updated after year end in discussion with the regulator in the event corrections are required. OGUK offers the materials and information in good faith and believes that the information is correct at the date of publication. The materials and information are supplied to you on the condition that you or any other person receiving them will make their own determination as to their suitability and appropriateness for any proposed purpose prior to their use. Neither OGUK nor any of its members assume liability for any use made thereof.
1. Foreword

Welcome to OGUK’s 2019 Environment Report, which provides an update on the environmental performance of the UK offshore oil and gas industry to the end of 2018. The report analyses and interprets data gathered by the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED), and covers emissions to atmosphere, discharges to sea, accidental oil and chemical releases, and waste disposal.

It also summaries the activities of OGUK groups and the OGUK Health, Safety and Environment Team over the last year to support the development of new environmental legislation and guidance, share lessons and good practice, increase efficiency and support the move to a net-zero economy, working with our members and stakeholders to maintain our social licence to operate. Over the past year, key areas of focus include the implications of Brexit on environmental legislation, EU ETS Phase IV, emission reductions, oil spill response, and continued engagement with the regulator.

OGUK is actively working with members to understand solutions to meet our commitment to the UK’s net-zero ambition by 2050 and the expectations of society whilst maintaining sovereignty of supply. The offshore industry faces some unique challenges in a mature and complex basin. There are opportunities to reduce our offshore emissions further and avoid emissions in future, specifically in routine flaring and power generation. This report looks at performance to date of all offshore emissions and outlines the areas for improvement.

In 2018, the total CO\textsubscript{2} equivalent emissions from the production of offshore oil and gas in the UK were 14.63 million tonnes, representing 3 per cent of the UK total. Over the past five years CO\textsubscript{2} emissions have stabilised with a small, annual variation, whilst production over the same period has increased by 20 per cent. This means today we are emitting less CO\textsubscript{2} per barrel of production than in 2014. Operators are making changes to processes and equipment offshore to continually improve efficiency and emissions performance.

Our environmental performance is broader than greenhouse gas (GHG) emissions and the industry works hard to ensure all operational emissions and discharges from our activities are well managed. Analysis of the 2018 data shows we are delivering stabilised environmental performance alongside increasing levels of production.

The mass of chemicals discharged increased overall, but the discharge of the most hazardous chemicals reduced by 7 per cent. Produced water discharges decreased slightly year on year, down 3 per cent from 143 million m\textsuperscript{3} to 139 million m\textsuperscript{3}. The total mass of dispersed oil discharged increased marginally to 2,182 tonnes, but concentrations remain well below the 30mg/l limit. Last year, there was a 22 per cent reduction in waste generated.

The amount of oil unintentionally released decreased in 2018 and the average mass released per incident was 0.05 tonnes. The unintentional release of chemicals increased by 44 per cent compared with 2017. Ninety-five per cent of the mass of chemicals released were of PLONOR or low hazard chemicals, and less than 1 kg of the highest hazard chemicals were released.

The industry takes its responsibilities for environmental management and compliance seriously as is demonstrated by the performance captured in this report. We hope you find it helpful and informative. Any queries should be directed to OGUK environment manager Louise O’Hara Murray on lmurray@oilandgasuk.co.uk.

Louise O’Hara Murray
Environment Manager, OGUK
2. Key Findings

There was a **4% increase** in production compared with 2017

14.63 million tonnes of CO₂e were emitted, **maintaining a stable level** of total emissions over the past five years

74% CO₂ emissions were from power generation

Upstream oil and gas operations contributed **3%** of total UK GHG emissions

**UKCS carbon intensity** (CO₂ emitted per unit of production) **decreased** from 23 kt/million boe to 21 kt/million boe

Methane emissions **increased by 800 tonnes** compared to 2017 – contributing 1.22 million tonnes CO₂e

1.2 million tonnes of gas were flared (3.5 million CO₂e), a **7% decrease on 2017**

Produced water discharged to sea **fell by 3%** from 143 million m³ to 139 million m³ over the past five years

The volume of produced water reinjected **increased 11%** to 60 million m³

Concentrations of dispersed oil in produced water discharged **remains below** the 30mg/l limit, at 16.1mg/l

Average Ra-226 concentration and average total NORM concentration **remains significantly below** the 0.1Bq/ml limit
167 tonnes of chemicals were discharged to sea per million boe produced

73% chemicals discharged were PLONOR

21,450 tonnes of drill cuttings were discharged to sea in 2018, a decrease from 2017

There were 293 accidental oil releases, totalling 14 tonnes. This is the lowest annual total since 2011

Average mass of oil released per occurrence was 0.05 tonnes

There were 187 accidental releases of chemicals, totalling nearly 470 tonnes.

The largest single release of 247 tonnes of low-hazard hydraulic fluid accounted for over half of the total

95% of the mass of chemicals released were of PLONOR or low hazard chemicals, and less than 1 kg of the highest hazard chemicals were released

MORE FACTS AND FIGURES

Scan code or visit oilandgasuk.co.uk/environmentreport
3. Permitted Offshore Emissions and Discharges

Introduction

The oil and gas industry on the UK Continental Shelf (UKCS) strives to continuously improve its environmental performance and efficiency in a mature basin while production is increasingly technologically challenging. Over recent years industry has increased production, improved efficiency and reduced the associated costs of oil and gas operations while maintaining environmental performance and focus on potential risks to the environment.

The Offshore Petroleum Regulator for Environment and Decommissioning (OPRED), part of the Department for Business, Energy and Industrial Strategy (BEIS), regulates the industry’s offshore emissions and discharges. UKCS operators must apply for a permit for emissions to air or discharges to sea, and these must be reported to OPRED through the Environmental Emissions Monitoring System (EEMS). As part of the permit application, companies must assess the potential environmental effects and any mitigation measures.

The emissions and discharges monitored include produced water, chemicals, drill cuttings, greenhouse gas emissions, gas flared and vented, and the amount of waste generated by upstream oil and gas operations.
3.1 UKCS Activity

Production in the basin improved in 2018, with an increase of 4 per cent compared with 2017 and an overall 20 per cent increase between 2014–18. Total production was around 619 million barrels of oil equivalent (boe), representing a fourth year of increasing production. This reversal of fourteen years of decline means that the basin now meets 59 per cent of UK oil and gas demand.

Throughout 2018 production efficiency remained at 74 per cent, the highest level for a decade, with improvements made in 2017 adding an additional 12 million boe to basin-wide production.¹

![Figure 1: UKCS Production](image)

¹ See OGUK Business Outlook 2019 www.oilandgasuk.co.uk/product/business-outlook-report/
3.2 The Role of Oil and Gas in Meeting Future Emissions Targets

OGUK welcomed the publication of Net Zero: The UK’s contribution to stopping global warming by the independent Committee on Climate Change (CCC) earlier this year. The CCC concluded that it is achievable for the UK to implement a new target of net-zero greenhouse gas (GHG) emissions by 2050 in England and Wales, and by 2045 in Scotland. GHG emissions have received increased stakeholder and wider societal attention in recent months. The Climate Change Act 2008 has been updated to reflect the ambitions in the report.

The CCC report recognises that the move to net-zero GHGs by 2050 will require action in resource and energy efficiency including energy demand, changes to societal choices in diet and travel, the electrification of industry, heat and transport, increased use of hydrogen, carbon capture and storage (CCS) and changes in land use.

The report acknowledges that a diverse energy mix is needed in the transition to a net-zero future to maintain our security of supply. The forecast demand for oil and gas in the UK in 2050 will exceed current estimates of supply from the UKCS. Locally produced oil and gas delivers huge economic benefit to the UK through jobs, exports, taxes and energy security. Maintaining energy sovereignty means avoiding premature cessation to UKCS production and displacement of production to other basins.

The UK offshore oil and gas industry has an important and constructive role to play in the transition and has the engineering expertise skills and knowledge to deliver operational emission reductions, continuous improvements in production efficiency and to support the advancement of low carbon and abatement technologies in future.

To achieve the net-zero goal, the CCC report calls for concerted effort and action by all to reduce emissions and for any remaining emissions in 2050 to be offset. As part of this, the offshore oil and gas industry is focused on the continued management and reduction of its operational emissions. Overall, CO$_2$ equivalent emissions (CO$_2$e) from UK offshore oil and gas production last year contributed 3 per cent of total domestic CO$_2$e emissions.

GHG CO$_2$e emissions on the UKCS have been falling since 2008. The offshore industry monitors and measures its offshore emissions and is taking actions to reduce them, which include: improved operational management; the decommissioning of older, more emission-intensive installations; lower emissions from new fields and use of more efficient technologies; energy-efficient technologies for power generation offshore; reduced routine flaring in greenfield projects; evaluating the opportunity to use renewable energy sources or connection to onshore power generation or to neighbouring offshore wind developments; reducing system leakages (for example, to flare stack); upgrading and altering equipment to maximise operational and energy efficiency; and participation in the EU Emissions Trading Scheme (EU ETS).

OGUK also facilitated a workshop in June 2019 enabling members to share emissions reduction projects and ideas and to familiarise themselves with policy developments in this area.

The following chapter examines in detail the sources and performance of offshore oil and gas industry emissions from 2006 to 2018.
3.3 Atmospheric Emissions

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

Combustion and flaring result in emissions of carbon dioxide (CO$_2$), carbon monoxide (CO), methane (CH$_4$), oxides of nitrogen (NO$_x$) and sulphur (SO$_x$). Small amounts of nitrous oxide (N$_2$O) are also emitted. Releases of volatile organic compounds (VOCs) and CH$_4$ may occur during tank loading or from firefighting equipment.

Upstream Oil and Gas Emissions in a Broader UK Context

The Kyoto Protocol defines six greenhouse gases (GHGs) including CO$_2$, CH$_4$, N$_2$O, hydrofluorocarbons (HFCs), perfluorocarbons (PFCs) and sulphur hexafluoride (SF$_6$). GHG emissions stem from various sources and it is widely accepted that these emissions are contributing to anthropogenic global climate change.

A changing energy supply is helping to decarbonise the UK’s energy mix. Country-wide, an estimated 449 million tonnes of CO$_2$e GHG emissions were emitted in the UK in 2018,$^2$ representing a 2.6 per cent fall from 2017 (460 million tonnes CO$_2$e). The reduction largely reflects changes in the power generation sector. The replacement of coal by gas and increased renewable capacity are key drivers and overall have led to a 43 per cent reduction in GHG emissions since 1990.

Upstream oil and gas operations contributed 3 per cent (14.63 million tonnes CO$_2$e) of total UK GHG emissions in 2018. A breakdown of the GHG emissions from offshore oil and gas activity is shown in Figure 2. Most of the GHG emissions are from CO$_2$, and a downward trend is seen from 2000. In recent years CO$_2$ emissions have stabilised with a small, annual variation of between 1 and 5 per cent year on year, whilst production over the same period has increased by 20 per cent.

---

Gas Flaring

Gas flaring is subject to consent under the Petroleum Act 1998, which aims to conserve gas by avoiding unnecessary wastage during hydrocarbon production. Operators are expected to minimise flaring as far as possible and all flaring activity must be reported in EEMS, with consents for specific flare volumes over a limited time frame granted by the Oil and Gas Authority (OGA).

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

Just over 1.2 million tonnes of gas were flared on the UKCS in 2018 — a 6 per cent decrease on 2017. This equates to around 3.5 million tonnes of CO₂e generated from flaring gas offshore in 2018, compared with 3.7 million tonnes in 2017, a 7 per cent reduction. Flaring activity has had the largest effect on the total offshore CO₂e emissions over the past five years.

Flaring is an inherently variable element of the industry’s GHG emissions as it is primarily a safety operation, designed to effectively and quickly remove highly combustible gases from the vicinity of the installation’s personnel and infrastructure. Moreover, during periods of non-routine activities — such as the commissioning phase for new installations and equipment, or the drilling and connection of new wells to existing installations — levels of flaring may increase until the gas can be captured and either used or exported. The decrease in flaring seen in 2018 is explained by the completion of such activities that were occurring on several installations in 2017.

---

Flare gas is reported under EEMS as either routine, maintenance, process upsets, well testing or gross, as shown in Figure 3. Gross is reported when a breakdown is not available and could therefore be the result of any of the categories.

Many installations are fitted with technology that allows for routine flaring, in line with policy at the time of design and commissioning. Retrospective changes to the design of these installations would be difficult due to limited physical space.

Establishing viable export routes for gas depends on the gas meeting the requisite quality and infrastructure being in place. Operators continually look to reduce the amount of gas they routinely flare as part of production. Exploring solutions to routine flaring has been identified as an area of industry-wide focus in the drive to reduce offshore emissions.

Figure 3: Breakdown of Gas Flaring by Source

![Figure 3: Breakdown of Gas Flaring by Source](source: EEMS May 2019)
The composition of the UKCS total flare emissions for 2018 is 99 per cent carbon dioxide and 1 per cent methane, which indicates efficient combustion practices overall.

![Figure 4: UKCS Total Flare Gas Composition](source)

**Gas Venting**

Venting is also subject to consent under the Petroleum Act 1998 through application to the OGA. All applications undergo a detailed review and all venting activity must be reported in EEMS.

Just over 95,100 tonnes of gas were vented on the UKCS last year, a 53 per cent increase on 2017. Nearly half of that total was due to a single installation with no gas export facility, where the gas emitted had a carbon dioxide content too high to enable ignition of the flare. The reservoir conditions have since changed, enabling the gas to be combusted via the flare system.

The release of gas through venting or flaring is controlled through the consent process by the OGA. As part of the approval process operators must consider other preferable options such as gas recovery where this is practicable and consult key stakeholders on the potential effect of releases of GHGs. The OGA is obliged to consider both the environmental impact and the economic feasibility of production.

Gas venting is reported under EEMS as either operational, maintenance, emergency or gross. Gross is reported when a breakdown is not available and could therefore be any of the other categories; the majority falls into this category, as shown in Figure 5.
The UKCS total vented gas composition for 2018 is broken down in Figure 6, showing that 51 per cent of the gas is carbon dioxide, 25 per cent VOCs and 24 per cent methane. Routine venting during production is therefore identified as an area for review and where potential reductions in GHG emissions offshore could be made. Improvement will depend on the availability and engineering design opportunities on the installation.
Carbon Dioxide Emissions

Hydrocarbon production increased by almost 20 per cent between 2014–18, and over the same period CO₂ emissions saw a 4.7 per cent increase. Last year saw a decrease in CO₂ emissions on the UKCS from 14.2 million tonnes in 2017, to 13.2 million tonnes in 2018. The main driver of this decrease, as outlined above, was reduced flaring.

Carbon dioxide emissions per unit of production on the UKCS (CO₂ intensity) continues on a downward trend from a peak in 2013, as shown in Figure 7. In 2018, the carbon intensity reached 21,338 tonnes of CO₂ per million boe, down from 23,016 tonnes per million boe the previous year.

Offshore installations are not connected to the national grid for power supply. Power is generated offshore to run pumps, equipment used in production processes, for electricity used for cooking, lighting and heat, as well as for compression equipment so that oil and gas can be transported onshore. CO₂ is released during power generation, and 74 per cent of CO₂ emissions (9.7 million tonnes) in 2018 were generated from fuel consumed by combustion equipment to provide electrical power and drive compressors for gas export. As shown in Figure 8, CO₂ is also emitted during flaring and venting offshore, which are necessary for maintenance, well testing and, crucially, for the safety of offshore workers.

Less energy was required per unit of production in 2018. The high proportion of emissions from power generation has been identified as a key area of focus in reducing offshore CO₂ emissions. Some incremental improvements have been seen by changes to the operations of turbines and deployment of new technology. OGUK is working with members to share these lessons across industry.

Figure 7: Carbon Dioxide Intensity Versus Production
Figure 8: Total Carbon Dioxide Emissions and 2018 Generation Source

- **Turbines**: 68%  
- **Engines**: 6%  
- **Heaters**: 2%  
- **Venting**: 0%  
- **Flaring**: 23%  
- **Other**: 1%

13.2 mt in 2018

Source: EEMS May 2019
International Comparison

In comparison with international counterparts, the UKCS’ maturity means that it is expected to have a higher carbon intensity. The recent improvements in this area highlight the positive work by companies on the UKCS during late-life asset management.

In 2018, the UKCS emitted 13.2 million tonnes of CO$_2$. This is comparable to Norway which released a total of 12.2 million tonnes, down from 12.8 million tonnes in 2016. However, Norwegian production was over twice that of the UK in 2018, meaning it produced at a lower carbon intensity. More assets producing from smaller fields, combined with the fact that the majority of UKCS assets are reaching the mature phase of their life cycle, has led to a higher carbon intensity over the long term compared with the Norwegian Continental Shelf (NCS), which is less mature and home to a smaller number of installations producing from larger fields.

However, while the UKCS’ carbon intensity may be higher than that of its North Sea neighbour (see Figure 9 below), this does not take into account emissions generated during importation of gas to the UK.

Figure 9: Carbon Intensity International Comparison

Source: OGUK; IOGP; NOROG

Under Embargo until 00:01am Wednesday 24 July 2019
**EU ETS**

The EU ETS is the central pillar of Europe’s decarbonisation policy. In recent years, the EU has moved to address an oversupply of carbon allowances and has seen an increase in price since 2016, from approximately €6 to around €25 per tonne at the end of 2018 — a 200 per cent rise, as shown in Figure 10.

Prices in 2018 averaged €16.15 and are anticipated to remain relatively high in future, with prices reaching €27/tonne in 2019.

Improving energy efficiency and/or switching to low-carbon energy supply will result in lower carbon compliance costs for offshore installations and may help make such projects more economic. Phase IV of the ETS starting in 2021 includes proposals for free allocation of allowances relating to energy efficiency improvements.

*Figure 10: Carbon Allowance Price Under EU ETS*

Almost all of the UK’s upstream industry, comprising offshore installations and onshore terminals, falls within the scope of EU ETS. Installations responsible for any CO₂ emissions are required to monitor and verify such emissions and surrender allowances to cover all their emissions each year. Since the industry is deemed to be at risk of carbon leakage, installations receive some free allowances based on historical performance relative to an industry benchmark. However, there are no free allowances allocated for emissions from electricity generation, and as offshore installations are not able to connect to the onshore national grid, they must generate their own electricity using produced fuel gas or diesel for all operational needs.

Such energy generation accounts for more than half the total CO₂ emissions from UK offshore installations. The effect of the ineligibility of emissions from electricity generation is that, uniquely among the six largest industrial sectors in the ETS, upstream oil and gas is short of allowances and must purchase them in the market each year to meet their ETS obligations.
Methane Emissions

Methane, a GHG, is estimated to be up to 28 times more potent than CO$_2$ over 100 years in terms of its ability to absorb heat and contribute to towards global warming.\textsuperscript{4} However, it has a shorter life span in the atmosphere. Methane emissions from UKCS operations rose from 42,700 tonnes in 2017 to 43,500 tonnes in 2018 (this is around 1.22 million tonnes CO$_2$e, or 8 per cent of the total GHGs emitted by the industry). As can be seen from Figure 11, the methane intensity per unit of production also follows a decreasing trend since 2013, with a slight increase in 2018.

\textbf{Figure 11: Methane Intensity Versus Production}

\begin{center}
\includegraphics[width=\textwidth]{figure11.png}
\end{center}

\textsuperscript{4} Data taken from the Global Warming Potentials for the 100-year time horizon, as detailed in the fifth assessment report.
The majority of methane emissions (88 per cent) are emitted from incomplete combustion of the flare and from vented sources, as shown in Figure 12.

**Figure 12: Total Methane Emissions and 2018 Generation Source**

- **Flaring**: 33%
- **Venting**: 55%
- **Other**: 5%
- **Turbines**: 6%
- **Engines**: 1%
- **Heaters**: 0%

1.2 mt in 2018

Source: EEMS May 2019

Under embargo until 00:01am Wednesday 24 July 2019
Other Emissions

Emissions of VOCs increased by 31 per cent to just over 50,100 tonnes in 2018. VOCs are primarily associated with venting and oil-loading operations and therefore increased volumes of vented gas has resulted in an increase in VOCs in 2017–18. As detailed above, there are ongoing challenges with gas quality that preclude ignition and result in either incomplete combustion of gas via the flare system, or venting.

Figure 13 shows the emission intensity based on total production for the other gases (N₂O, NOₓ, CO and SO₂) remained stable or continued to show a downward trend.

*Figure 13: Offshore Emission Intensity Based on Total Production for Other Gases*

Source: EEMS May 2019; OGA
Fluorinated Gases

Fluorinated gases (F-gases) are known GHGs and contribute towards global warming. Their use is regulated under the 2014 EU Fluorinated Greenhouse Gas Regulation as part of the Kyoto Protocol. Offshore, F-gases are used for industrial applications such as refrigeration, air conditioning and, to a lesser extent, fire protection systems and electrical switch gears. F-gases are not emitted as a direct result of upstream activities, but fugitive emissions may be released from equipment such as valves and pipework.

Figure 14 shows a 19 per cent decrease on the CO₂e released in 2018 compared with 2017.

Figure 14: CO₂ Equivalent for Fluorinated Gas Releases

Source: EEMS May 2019
3.4 Produced Water

When oil and gas are produced, water within the hydrocarbon reservoir is also brought to the surface. This produced water can make up over 95 per cent of produced liquids in some fields and is separated from the hydrocarbons before either being reinjected into the reservoir to provide reservoir support and maintain production or treated and discharged to sea. Operators gain approval for produced water discharges by applying for a permit from OPRED.

Produced Water Volumes
The total amount of produced water discharged on the UKCS follows the general trend of production and has therefore been declining since 2000 (see Figure 15). Over time, however, the decline in production has been greater than the decrease in produced water generated. This is because as the UKCS matures, hydrocarbons become harder to reach and extract and the process generates larger volumes of produced water.

Since 2014, the UKCS has reversed the production decline of the preceding 15 years, resulting in a rise in total produced water to 199 million cubic metres in 2018 (accounting for approximately 70 per cent of total well stream fluids). Despite this, the amount of produced water discharged to sea fell by 3 per cent from 143 million cubic metres in 2017 to 139 million cubic metres in 2018. This is because record levels of produced water were reinjected into suitable sub-surface strata or reservoirs as an alternative to discharging to sea and, where technically feasible, to aid enhanced oil recovery (EOR). The amount of produced water reinjected to the subsurface increased to 60 million cubic metres last year, up 11 per cent from 2017.

![Figure 15: Produced Water Discharged to Sea and Reinjected Versus Production](source: EEMS, May 2019; OGA)
International Comparison

The International Association of Oil & Gas Producers (IOGP) reports that 0.5 tonnes of produced water were discharged and 0.8 tonnes were reinjected per tonne of hydrocarbon produced globally (both onshore and offshore) by IOGP member companies in 2017. In comparison, 1.6 tonnes of produced water were discharged and 0.7 tonnes reinjected per tonne of hydrocarbon produced on the UKCS during 2018. This reflects the maturity of the UKCS and its technically challenging environment compared with other basins around the world. It is therefore to be expected that more produced water is generated in the UK than the global average.

2.3 tonnes of produced water were generated per tonne of hydrocarbon on the UKCS in 2018, compared with 0.9 tonnes of produced water per tonne of hydrocarbons on the NCS. This is because many of the larger fields in Norwegian waters are yet to reach the high levels of water as a percentage of total production, and new fields with high levels of daily production are continuing to come on-stream. Twenty-three per cent of produced water on the NCS is reinjected into the sub-surface, a similar amount to the UK, which reinjected 30 per cent.

Produced Water Composition

Produced water accumulates small amounts of naturally occurring substances through contact with the reservoir rock, including dispersed oil, dissolved organic compounds, naturally occurring radioactive materials (NORM) and production chemicals injected into the process. The composition of produced water is determined by the reservoir geology, maturity and stage of production life.

Dispersed Oil in Produced Water

OSPAR Recommendation 2001/1 requires that individual installations do not exceed an average dispersed oil-in-water concentration of 30 milligrams per litre (mg/l). At such low concentrations, oil rapidly disperses and is quickly broken down by naturally occurring bacteria. In 2018, the average concentration across industry was 16.1 mg/l, up from 15.3 mg/l in 2017, due more to the decreasing volumes of produced water than an increase in the mass of dispersed oil discharged. Around 2,180 tonnes of dispersed oil were discharged to sea with produced water in 2018, compared to 2,140 tonnes in 2017 and 3,159 tonnes in 2008. The total mass of oil discharged increased by 2 per cent from 2017, while the total volume of produced water decreased by 3 per cent.

International Comparison

The concentration of oil in produced water on the UKCS remains comparable to global and Norwegian levels. The global average was 15.2 mg/l in 2017 while Norwegian data show concentrations of 12.1 mg/l. See IOGP Environmental Performance Indicators 2017 data. A 2018 report has not been published at the time of this publication. See Norsk Olje & Gass Environmental Report 2018 at www.norskoljeoggass.no/globalassets/dokumenter/miljo/miljorapporter/environmental-report-2018.pdf. See Norsk Olje & Gass Environmental Report 2018 at www.norskoljeoggass.no/globalassets/dokumenter/miljo/miljorapporter/environmental-report-2018.pdf.
Naturally Occurring Radioactive Materials (NORM) In Produced Water

Radium and many other radionuclides occur naturally in seawater and have done so for millions of years. The UKCS rock strata contains radionuclides of the uranium and thorium decay series, some of which dissolve into the water in the reservoir. These materials do not have a significant impact on the marine environment or human health. Discharges of NORM are controlled through authorisations issued under the Radioactive Substances Act (RSA) 1993. A condition of these authorisations is to notify the relevant environment agency if the concentration of Ra-226 is greater than 0.1 becquerel per millilitre (Bq/ml).

There has been a 14 per cent decrease in the total NORM activity (Pb-210, Ra-228, Ra-226) discharged to sea compared with 2017. The amount of NORM discharged is dependent on the reservoir conditions and the volume of produced water discharged. The average Ra-226 concentration and the average total NORM concentration remain consistently and significantly below the 0.1 Bq/ml limit by two orders of magnitude.
Figure 17: Breakdown of NORM Discharged in Produced Water

Source: EEMS May 2019
3.5 Chemicals

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 ensure responsible environmental performance. OPRED must permit all discharges in advance, and operators are obliged to continually review the volume and the types of chemicals they use.

Only chemicals that have been registered with the Centre for Environment, Fisheries and Aquaculture Science’s (CEFAS) Offshore Chemical Notification Scheme (OCNS) are permitted for use and discharge. The OCNS applies the OSPAR Harmonised Mandatory Control Scheme (HMCS), developed through OSPAR Decision 2002/2 (as amended by OSPAR Decision 2005/1) and its supporting recommendation. The OSPAR HMCS contains a list of chemicals that it considers to ‘Pose Little Or No Risk’ (PLONOR) to the environment, as well as those for which there is a substitution warning (SUB) where a less environmentally hazardous alternative should be used if practicable.

**Mass of Chemicals Discharged**

In 2018, just under 103,500 tonnes of chemicals were discharged to sea (167 tonnes per million boe produced). Sixty-four per cent of this (66,600 tonnes) derived from drilling activities, 34 per cent (35,000 tonnes) from production-related activity, and 2 per cent (1,850 tonnes) were pipeline chemicals.

The mass of chemicals discharged is dominated by drilling chemicals. These are used in drilling fluids and cement which are important for safety and well control. Over the last decade, however, the amount of drilling chemicals discharged has fallen by 35 per cent, in line with the reduction in drilling activity over this period. The spike in 2013 (see Figure 18) is due to more complex wells being drilled and is out of step with the downward trend observed since 2010.

Although UKCS production has been in decline since 2000, there has been a gentler fall in the use of production chemicals. This is because of the basin’s maturity, which requires greater use of chemicals to improve recovery rates, help maintain asset integrity and ensure compliance with environmental permit conditions. In 2018, over 2,600 tonnes more production chemicals were discharged to sea than in 2017 — a rise of 8 per cent.

Chemicals used for pipeline maintenance are designed to prevent corrosion or scale build-up. As shown in Figure 18, the amount discharged increased slightly on 2017, and accounted for 2 per cent of total chemicals discharged. As with drilling activity, pipeline works will fluctuate from year to year and chemical discharge will largely reflect this.
Composition of Chemicals Discharged

In 2018, 73 per cent of chemicals discharged to sea from offshore oil and gas operations were PLONOR and 6 per cent were SUB chemicals. Operators were obliged to phase out, where practical, the use of all SUB chemicals by the end of 2017. A review of the OSPAR Recommendation 2006/03, was undertaken as part of the Offshore Industry Committee (OIC) meeting held in March 2019, the outcome of which was to revise the recommendation to enable the phase-out programmes to continue. Industry will be encouraged to review any assessments made on the suitability of alternatives to SUB chemicals, and to determine whether new suitable alternatives are available.

2018 saw a 7 per cent decrease in the volume of SUB chemicals discharged to sea. In addition, the number of different types used in production operations continues to fall, from 216 in 2011 to 200 last year. Whilst operators encourage suppliers to look for and develop replacements to these chemicals, in some cases it is not currently technically feasible, for safety and operational reasons, to use an alternative. In some cases, changes to chemicals used offshore may have an impact on other discharges such as the concentration of oil in produced water.

International Comparison

Just over 139,000 tonnes of chemical additives were discharged on the Norwegian Continental Shelf in 2017 from upstream oil and gas operations, 14,500 tonnes less than the previous year. Eighty-nine per cent of these chemicals fell into the green category and 11 per cent yellow, while 96 tonnes and 5 tonnes were discharged from the red and black categories, respectively.

---

8 See www.ospar.org/documents?v=7336
9 Environmental Goals for the Discharge by the Offshore Industry of Chemicals that Are, or Which Contain Substances Identified as Candidates for Substitution.
10 Norwegian classifications do not match directly with that of PLONOR and SUB of the UK. For more information, see Norsk Olje & Gass Environmental Report 2018. Red and black are used to designate environmental hazardous products.
Figure 19: 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 contain hazardous materials listed under OSPAR Annex A

Source: EEMS May 2019

Figure 20: Breakdown Pipeline Chemicals Discharged by Classification

*Other includes those chemicals reported in EEMS that are not classified as PLONOR or SUB but contain hazardous materials listed under OSPAR Annex A

Source: EEMS May 2019
3.6 Drill Cuttings

Drill cuttings are rock fragments generated during well drilling. They are brought to the surface by drilling fluids which surround the wellbore and are either water- or oil-based, depending on geological, safety and environmental factors. The cuttings, which are coated in the chosen drilling fluid, are disposed of according to the fluid type.

Water-based fluid drill cuttings pose a lower environmental hazard and are generally permitted for discharge to sea. Oil-based fluid cuttings cannot be discharged to sea unless they are treated to reduce the oil-on-cuttings content to below 1 per cent of the total mass. Whether oil- or water-based, as part of the permitting process, operators must conduct stringent environmental assessments to determine the risks posed by cuttings discharged.

As with drilling chemicals, the mass of cuttings discharged to sea is closely related to drilling activity. At 21,450 tonnes, 2018 saw a decrease in drill cuttings discharged in comparison with the previous years, along with a significant decrease in the total drill cuttings generated. With 258 kilometres drilled on the UKCS in 2018, this represents 83 tonnes of cuttings discharged per kilometre drilled. The peak in 2013 (shown in Figure 21 below) is due to more complex wells being drilled.

Of the 15,800 tonnes of cuttings coated with water-based fluids, 7 per cent were returned to shore for treatment and disposal, with the rest discharged to sea or injected as permitted. Of the 31,500 tonnes of oil-based fluid cuttings, 71 per cent (22,500 tonnes) were returned to shore for treatment, an increase from 53 per cent in 2017. Around 4,760 tonnes were thermally treated offshore to reduce their oil content to below 1 per cent and discharged to sea, while the remainder were injected into the reservoirs.

![Figure 21: Drill Cuttings Discharged to Sea](image)

**International Comparison**

90,800 tonnes of water-based fluid cuttings were discharged to the sea during oil and gas production in Norway in 2017. Of the 97,100 tonnes of oil-based fluid cuttings generated, 35 per cent were re-injected, 65 per cent transported to land, and none were discharged to sea.
3.7 Waste

According to the EU Waste Framework Directive (2008/98/EC)\textsuperscript{11}, waste means “any substance or object that the holder discards or intends or is required to discard”. As with the creation of any product, oil and gas production generates waste that must be disposed of. Waste originates at various points in the life cycle and can be found in different states, for example, solid and liquid, hazardous and non-hazardous materials. 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, result in better environmental performance.

Waste is segregated and stored appropriately on the installations before transportation to shore, where it is transferred to a licensed waste contractor for processing. As disposal to landfill is costly and is not sustainable in the long term, operators therefore segregate wastes to reduce the quantity of material going to landfill and to maximise reuse and recycling.

The total amount, as well as the form, of waste generated varies from year to year depending on the levels of exploration, production, maintenance and decommissioning. The total amount fell to just under 120,000 tonnes in 2018 — a 22 per cent decrease on 2017, despite overall production increases, primarily as a result of reduced operational waste. This will be encouraging for operators who, in their drive to improve operational efficiencies, have sought to re-use and recycle more equipment instead of buying new and disposing of useable parts.

There was a 39 per cent increase in decommissioning waste between 2017 and 2018. While decommissioning remains a small contributor to the total mass of waste, activity is expected to increase in the coming years.\textsuperscript{12}

\textsuperscript{11} ec.europa.eu/environment/waste/framework/
\textsuperscript{12} OGUK’s Decommissioning Insight 2018 is available to download at www.oilandgasuk.co.uk/decommissioninginsight
Waste Composition and Disposal

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

Sludges, liquids and tank washing make up the largest category of waste (22 per cent) disposed of in 2018. This category includes the backload of drilling muds. In comparison with 2017, there was a 56 per cent decrease in waste produced from this stream. Comprising over half of total waste returned to shore, liquid wastes are generally not separated from one another offshore due to space restrictions, giving rise to such a sizeable category.
Figure 23: Operational and Decommissioning Waste

Source: EEMS May 2019
As shown in Figure 24, approximately 27,900 fewer tonnes were sent to landfill in 2018 than 2017 and almost 36,700 tonnes of total waste were reused or recycled. Disposal routes categorised as “other” include the treatment of aqueous wastes, composting and land spreading, and these also saw a sharp decline.

Of the 6,030 tonnes of decommissioning waste generated in 2018, 72 per cent was either re-used, recycled or used for power generation.

*Figure 24: Total Waste Generated Offshore by Disposal Method*
4. Environmental Performance Benchmarking

Introduction

Each year, OGUK carries out a benchmarking exercise for operators reporting data into EEMS to gain an overview of their individual performance in the context of the overall industry. Areas of concerning or promising performance can be identified, with the aim of achieving better industry-wide performance.

The analysis is presented anonymously with each company allocated a letter in each category. A single operator’s performance cannot be tracked from one graph to another. Each individual operator will be informed of their rankings in each category, without the ability to attribute the environmental performance of the other companies.

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

The average concentration of dispersed oil discharged to sea in produced water across industry increased by 5 per cent, from 15.3 mg/l in 2017 to 16.1 mg/l in 2018. Despite the increase, the average remains below OSPAR’s annual recommended limit of 30 mg/l.

Average oil-in-water concentrations for individual operators are the result of several factors. Those operators with higher values may have more gas production or challenging reservoirs, for example. The operator benchmarking illustrated in Figure 25 below therefore provides a general picture of industry dispersed oil-in-water performance, but cannot be interpreted as some operators performing better than others.

The large concentrations reported for two gas installations are the result of very small volumes of produced water discharged over a short time frame and do not represent sustain discharges at high oil concentrations. The total oil discharged by these two operators was less than one tonne.

Figure 25: Concentration of Dispersed Oil in Produced Water per Operator by Hydrocarbon Type, 2018

Source: EEMS, May 2019
4.2 Discharged Drill Cuttings

Figure 26 shows the distribution of drill cuttings discharged to the sea across UKCS operators in 2018. The amount discharged depends on the number and length of wells each operator has drilled over the year, and therefore the volume increases during intensive drilling campaigns. On average, 212 tonnes of drill cuttings per well were discharged to sea in 2018, lower than the 502 tonnes discharged in 2017.

Three of the 26 operators discharged oil-based fluid cuttings in 2018, fewer than in 2017. All discharged oil-based cuttings undergo processing and cleaning on-board to bring the oil-on-cuttings content to below 1 per cent. The trend of increased oil-based fluid cuttings being discharged to sea continued in 2018, means fewer cuttings are being shipped to shore for processing and landfill.

*Figure 26: Cuttings Discharged to Sea per Operator, 2018*
4.3 Production Chemicals

In 2018, the amount of production chemicals discharged per operator ranged from 0 to nearly 4,500 tonnes. This does not directly correlate to production levels as differing hydrocarbon properties and process conditions dictate the amount of chemicals used. The mean amount of chemicals discharged to sea per operator increased in 2018 to just over 1,000 tonnes, from 852 tonnes in 2017.

A total of 2,415 tonnes of oil equivalent were produced per tonne of production chemical discharged to sea in 2018, a decrease on the 2,625 tonnes of oil equivalent in 2017.

*Other includes those chemicals reported in EEMS that are not classified as PLONOR or SUB but contain hazardous materials listed under OSPAR Annex A

Source: EEMS May 2019
4.4 Total Offshore Atmospheric Emissions

Atmospheric emissions for facilities across the UKCS for each operator are shown in Figure 28 below, broken down by type of gas emitted. The majority of emissions are CO$_2$, while N$_2$O and CH$_4$ emissions per operator are shown more clearly in Figure 29 which keeps the same relative position for each operator.

On average, 77,960 tonnes of GHG emissions were produced per production installation on the UKCS in 2018, an increase on the average of 64,567 tonnes in 2017.

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

Figure 28: GHG Emissions per Operator by Emission Type, 2018
Figure 29: GHG Emissions per Operator Excluding CO₂, 2018

Figure 30 shows the remaining reportable atmospheric emissions (CO, VOC, SO₂, NOₓ) emitted per operator, in the same order as Figure 28 and 29.

Figure 30: Other Emissions per Operator, 2018

Source: EEMS May 2019
5. Accidental Releases

Introduction

The UK oil and gas industry does its utmost to minimise accidental oil and chemical releases by addressing the plant, process and people elements that could prevent or mitigate such releases. The industry invests in these barriers through maintenance programmes to ensure the integrity of equipment; the provision of multiple physical barriers, such as downhole safety valves, closed drains, and bunding; through development of handling procedures that minimise the potential for releases; and in ongoing staff training and competence management to ensure personnel manage any risks to the environment. Through OGUK forums and work groups, its members are encouraged to share experiences from incidents and lessons learnt.

Despite these efforts, some accidental releases to sea still occur. Safety legislation requires that certain hydrocarbon or chemical releases — generally those with potential to cause significant harm to the safety of personnel — are reported to the Health and Safety Executive (HSE). Environmental regulations go further, any and every hydrocarbon or chemical release that reaches the marine environment, regardless of size or potential to cause harm, must be reported to OPRED through the submission of a Petroleum Operations Notice 1 (PON1).

Furthermore, every offshore installation has an oil pollution emergency plan (OPEP), approved by OPRED, setting out arrangements for responding to incidents to minimise the effect of releases. The plan takes into consideration the type of oil produced at the installation, the well flow rates and the inventory, possible scenarios for releases, environmental sensitivities, and whether and where any large oil release might reach the shoreline.
5.1 Overview 2011–18

PON1 data are publicly available on the BEIS website and updated regularly. The following analysis is based on the PON1 dataset from 2011–18. Further analysis has been carried out to categorise PON1 data from this period by product released, hazard category and by source of accidental releases. For the first time, those incidents still under review are included in the 2018 figures.

The amount of chemicals and oil accidentally released to the marine environment varies over the last seven years, highlighting the sensitivity of these data to single, low-frequency, high-mass events. The largest single oil release in 2018 was 2 tonnes, while the largest chemical release in 2018 was 247 tonnes.

The total mass of chemicals and oil released in 2018 was higher than in 2017, reversing the slight decline that was seen in previous reports. The total amount of oil and chemicals accidentally released last year is a fraction of the total mass discharged to sea from assets under permits (see following sections).

Figure 31: Accidental Chemical and Oil Release Mass

![Graph showing accidental chemical and oil release mass from 2011 to 2018](source: OPRED, May 2019)

13 The BEIS PON1 data are available at itportal.decc.gov.uk/eng/fox/pon1/PON1_PUBLICATION_EXTERNAL/viewCurrent
5.2 Accidental Oil Releases in Context

In 2018, there were 293 accidental oil releases on the UKCS, during which more than 14 tonnes of oil were released to the marine environment. To put this into context, in the same year, approximately 2,182 tonnes of oil were discharged to sea in produced water, under permit. This means that accidental oil releases represented 0.7 per cent of the total oil that entered the marine environment. Furthermore, 84 million tonnes of oil equivalent were produced in 2018, meaning that accidental oil releases represented less than 0.00002 per cent of total oil and gas production.

The average annual reported accidental oil release size has varied since 2011, from a low of 0.1 tonnes to a high of 2.12 tonnes. The number of releases has stayed relatively stable over the period, averaging around 277 releases each year, with a range of between 246 and 307. Low-frequency, high-mass releases form a large part of these annual totals, as shown in Figure 32. The average yearly mass released for the period is 140 tonnes, although the yearly range extends between 14 tonnes in 2018 and 522 tonnes in 2012. 2018 saw the lowest mass released in the eight-year period covered.

In 2018, the average mass of oil released per occurrence fell to 0.05 tonnes, the lowest of any year since 2011 and lower than the average of 0.58 tonnes for the overall 2011–18 period. Since 2011, oil releases of more than 50 tonnes made up less than 0.23 per cent of the total number of releases, but almost 75 per cent of the total mass released. Four releases totalled more than 836 tonnes of oil.

Figure 32: Oil Release Mass and Number

![Figure 32: Oil Release Mass and Number](image-url)
International Comparison

International comparisons are not straightforward, as differences in the legislative and cultural norms in the industry worldwide can lead to different reporting behaviours. However, the IOGP reported a worldwide total of 1,009 oil releases larger than 1 boe in 2017, representing a total of 6,713 tonnes of oil. Of this, 244 tonnes were from offshore installations, with an average spill size of 2.5 tonnes.\textsuperscript{14}

The same dataset gives a European average of 0.15 tonnes released per million tonnes of offshore hydrocarbon production. In comparison, the UKCS reported approximately 0.17 tonnes accidentally released per million tonne of hydrocarbon production in 2018, a second year of decrease following 2017’s average of 0.29 tonnes.

To put this further into context, Norway saw 0.17 tonnes accidentally released per million tonnes of hydrocarbons produced in 2015, falling to 0.07 tonnes in 2016, and 0.05 tonnes in 2017. The average mass released per reported spill in Norway in 2017, the most recent year for which data is available, was 0.23 tonnes compared to 0.05 tonnes in the UKCS.\textsuperscript{15}

\textsuperscript{14} See IOGP Environmental Performance Report Indicators 2017
\textsuperscript{15} The Norsk Olje & Gass Environmental Report 2018 is available to download at www.norskoljeoggass.no/en/Publica/Environmental-reports/
5.3 Accidental Oil Releases Breakdown

Releases by Oil Type
Determining the oil product type is an important element of an oil spill response; it enables understanding of how the release will behave in the marine environment under varying conditions and helps to determine the appropriate response strategy.

Diesel and light oils will be rapidly broken up by wind and wave action if released, after which they will evaporate. More persistent oil spills will be monitored and appropriate clean-up operations will take place, as described in the installation’s OPEP. This may include allowing the oil to break up through the action of wind and waves and then be digested by naturally occurring oil-degrading bacteria; mechanical recovery of oil at sea; use of dispersants to facilitate break-up of the oil; or active protection of sensitive areas along the coast, together with collection and recovery of oil along the shoreline, should it come ashore.

In 2018, crude was the most common hydrocarbon type released, with 5.5 tonnes of crude accounting for 39 per cent of the total. There were 63 releases of crude, one of which was over 2 tonnes. The next largest category was diesel, of which 3.1 tonnes were released (22 per cent of the total), followed by lube oil (2.1 tonnes, 15 per cent).

Figure 33: Mass and Number of Oil Releases by Product Type, 2018
Understanding source trends for past release data allows operators to develop plans to target operational areas where accidental releases have been more frequent. However, the limited information included in the PON1 database on the circumstances leading to releases means they are allocated to broad categories. In addition, the impact of individual high-mass releases on the data makes trending difficult. The reported masses are the worst-case estimations for each incident and so the actual amount released is likely to be less. The totals for all oil releases are shown in Figure 34, with outlier releases (those greater than 50 tonnes) shown cross-hatched.

The following analysis includes direct causation information where this is attributable from the source data. Environmental incidents are complex and usually result from a combination of factors, as demonstrated in the Swiss cheese model. Therefore, the analysis first identified whether the direct cause of releases was a result of a breach in asset or operational integrity. Asset integrity breaches are the direct cause associated with most of the oil released across the period.
Figure 35 below excludes the outliers for clarity. Asset integrity related releases are in the majority for all but one year in the period.

The following tables provide a breakdown of the oil releases over the period by the top ten systems and equipment categories. As can be seen, most of the systems and/or equipment types shown have both a high frequency of releases and relatively high masses of oil released. Utilities equipment such as ROVs and cranes have nearly 200 releases (97 and 98 respectively), but the mass release is on average 1.5kg. Six categories appear in the top ten by both mass and frequency of release over the period: drainage systems, bulk transfer systems, hydraulic systems, diesel systems, production systems and storage systems.
**Figure 36: Top Ten Systems by Number of Releases**

<table>
<thead>
<tr>
<th>System / Equipment</th>
<th>Number of Releases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drainage Systems</td>
<td>283</td>
</tr>
<tr>
<td>Bulk Transfer Systems</td>
<td>248</td>
</tr>
<tr>
<td>Hydraulic Systems</td>
<td>183</td>
</tr>
<tr>
<td>Diesel Systems</td>
<td>150</td>
</tr>
<tr>
<td>Production Systems</td>
<td>112</td>
</tr>
<tr>
<td>Cranes</td>
<td>98</td>
</tr>
<tr>
<td>ROV</td>
<td>97</td>
</tr>
<tr>
<td>Wells and Associated Systems</td>
<td>92</td>
</tr>
<tr>
<td>Pumps and Turbines</td>
<td>58</td>
</tr>
<tr>
<td>Tanks / Storage Systems</td>
<td>58</td>
</tr>
</tbody>
</table>

**Figure 37: Top Ten Systems by Mass of Releases**

<table>
<thead>
<tr>
<th>System / Equipment</th>
<th>Mass of Oil (Tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Wells and Associated Systems</td>
<td>412.52</td>
</tr>
<tr>
<td>Pipelines, umbilicals and flowlines</td>
<td>259.73</td>
</tr>
<tr>
<td>Production Systems</td>
<td>106.14</td>
</tr>
<tr>
<td>Compressors</td>
<td>57.15</td>
</tr>
<tr>
<td>Bulk Transfer Systems</td>
<td>39.59</td>
</tr>
<tr>
<td>Diesel Systems</td>
<td>36.39</td>
</tr>
<tr>
<td>Hydraulic Systems</td>
<td>26.90</td>
</tr>
<tr>
<td>Produced Water System</td>
<td>15.60</td>
</tr>
<tr>
<td>Drainage Systems</td>
<td>13.93</td>
</tr>
<tr>
<td>SCM</td>
<td>8.71</td>
</tr>
</tbody>
</table>
Figure 38 shows releases from these systems with the attributed cause of release, including two of the outlier oil releases in the period.

*Figure 38: Direct Cause by System/Equipment Type*

Once outliers are excluded, as shown in Figure 39, it is easier to see that the predominant direct cause varies across the systems/equipment categories, with operational integrity issues being a causal factor in the majority of releases from drainage and diesel systems, while asset integrity is identified as a causal factor in releases from wells, bulk transfer, hydraulics and production systems.

*Figure 39: Direct Cause by System/Equipment Type (Excluding Outliers)*
5.4 Accidental Chemical Releases in Context

In 2018, almost 470 tonnes of chemicals were accidentally released in 187 incidents on the UKCS. Most offshore chemicals are diluted and the reporting of releases by mass is not representative of the relative quantities of potentially environmentally harmful substances released to sea. In many cases, the largest single ‘chemical’ accidentally released to sea is the water (H\textsubscript{2}O) used as a solvent.

To put this into context, approximately 302,108 tonnes of chemicals were used on the UKCS last year, 103,483 tonnes of which were discharged under permit. Accidental releases therefore represent 0.16 per cent of the total mass of chemicals used, and 0.45 per cent of the chemicals intentionally discharged to sea under permit. The average reported chemical release size reached 2.51 tonnes in 2018 — higher than the previous two years but below the annual average for the 2011–18 period, which stands at 2.59 tonnes.

The total amount of chemicals released in 2018 has increased by 44 per cent from 2017. These figures are influenced by single high-mass events. Over 247 tonnes — 53 per cent of the annual total — were the result of one release and accounted for the entire increase against 2017 figures.

International Comparison

IOGP reported 132 offshore chemical releases totalling 1,347 tonnes in 2017, giving an average release size of 10.2 tonnes, compared to the UK average of 2.51 tonnes.

In 2017, 914 tonnes of chemicals were accidentally released in the Norwegian sector, equating to 4.5 tonnes of chemicals released per million tonnes of production. This is comparable with the UK sectoral average of 5.6 tonnes per million tonnes of production.
5.5 Accidental Chemical Releases Breakdown

2018 Releases by Chemical Hazard Category and Source
The chemical PON1 data have been assigned hazard categories to gain greater understanding of any potential effect on the marine environment. The CEFAS OCNS data were used to produce the classifications detailed below. More detail is given in Appendix 1.

Figure 41: Hazard Ranking Categories for the Breakdown of Accidental Chemical Releases

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

In 2018, nearly 95 per cent (443 tonnes) of all accidental chemical releases on the UKCS fell into the low and PLONOR hazard categories. Less than 1kg of the mass released fell into the high hazard category, 0.000029 per cent of the total.

16 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

17 Appendix found at www.oilandgasuk/environmentreport
Figure 42: Total Mass of Accidental Chemical Releases by Hazard Category, 2018

Figure 43 expands the releases across the 2011–18 period by hazard category. During this time, 3,853 tonnes of chemicals were reported in PON1s on the UKCS, representing a total of 1,490 incidents. PLONOR and low hazard category chemicals make up the majority (2,853 tonnes, 74 per cent) of the mass released. High and medium hazard category chemicals contributed 6.7 per cent (255 tonnes) and 2 per cent (78 tonnes) by mass respectively, with the remainder (666 tonnes, 17 per cent) falling into the unattributable category. In 2018, 25 tonnes could not be categorised from the available data.

There has been a 25 per cent (just over 158 tonnes) decrease in the mass of chemicals accidentally released between 2011 and 2018. The total number of incidents decreased in 2018, down to 253, the lowest since 2011. The average reported release size has also fallen, from 2.22 tonnes in 2011 to 1.85 tonnes in 2018. Continued efforts within industry to raise awareness of the reporting requirements and encouragement to report accidental releases may result in an increase in the number of the accidental chemical releases recorded.
Figure 43: Mass of Accidental Chemical Releases by Hazard Category and Number of Releases

Figure 44 shows the breakdown by cause for the period, with outlier releases shown cross-hatched. Asset integrity breaches were the cause of most releases in each year of the period except 2013, when more were attributable to operational integrity breaches.

Figure 44: Accidental Chemical Releases Breakdown by Direct Cause

Source: OPRED, May 2019; OGUK
Figures 45 and 46 provide a more detailed breakdown of chemical releases by source system/equipment for the period. Seven categories appear in both the top ten for the period: hydraulics systems, pipelines, umbilicals and flowlines, tanks/storage, wells and associated subsea equipment, chemicals systems, bulk transfer systems and drilling systems.

**Figure 45: Top Ten Systems by Number of Chemical Releases**

<table>
<thead>
<tr>
<th>System / Equipment</th>
<th>Number of Releases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydraulic Systems</td>
<td>416</td>
</tr>
<tr>
<td>Chemical Systems</td>
<td>289</td>
</tr>
<tr>
<td>Drilling Systems</td>
<td>195</td>
</tr>
<tr>
<td>BOP</td>
<td>166</td>
</tr>
<tr>
<td>Bulk Transfer Systems</td>
<td>130</td>
</tr>
<tr>
<td>Pipelines, Umbilicals and Flowlines</td>
<td>96</td>
</tr>
<tr>
<td>Conductor Tensioner</td>
<td>95</td>
</tr>
<tr>
<td>Wells and Associated Systems</td>
<td>86</td>
</tr>
<tr>
<td>Tanks / Storage Systems</td>
<td>62</td>
</tr>
<tr>
<td>Water Injection</td>
<td>56</td>
</tr>
</tbody>
</table>

**Figure 46: Top Ten Systems by Mass of Chemical Releases**

<table>
<thead>
<tr>
<th>System / Equipment</th>
<th>Mass of Releases (Tonnes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydraulic Systems</td>
<td>1220.40</td>
</tr>
<tr>
<td>Pipelines, Umbilicals and Flowlines</td>
<td>331.43</td>
</tr>
<tr>
<td>Tanks / Storage Systems</td>
<td>246.41</td>
</tr>
<tr>
<td>Wells and Associated Systems</td>
<td>212.00</td>
</tr>
<tr>
<td>Chemical Systems</td>
<td>177.77</td>
</tr>
<tr>
<td>Bulk Transfer Systems</td>
<td>153.83</td>
</tr>
<tr>
<td>SCM</td>
<td>137.75</td>
</tr>
<tr>
<td>Drilling Systems and Equipment</td>
<td>92.79</td>
</tr>
<tr>
<td>Risers</td>
<td>48.06</td>
</tr>
<tr>
<td>Drainage Systems</td>
<td>42.16</td>
</tr>
</tbody>
</table>
Figure 47 shows the cause category for each system. For tanks and storage systems, the primary cause of releases is operational breaches, as it is for drilling systems and equipment. For the other categories, asset integrity is more common.

Figure 47: Accidental Chemical Releases Direct Cause by System/Equipment Category

Source: OPRED, May 2019; OGUK
6. Significant Issues and Activities

Introduction

OGUK’s Health, Safety and Environment Team manages the regulatory pressures emerging from governments and Europe that affect the licence to operate. This includes monitoring and risk-assessing relevant legislation and identifying potential areas of concern for members and stakeholders.

The team also looks to influence the development of legislation to ensure that industry expenditure is directed to areas that will provide optimum environmental benefit. Key stakeholder interfaces are maintained, allowing OGUK to play an active role in policy formation across government and regulators, and to ensure that maximising efficiency is a consideration in the implementation of legislative requirements.

The OGUK team also works with members and other stakeholders to generate supporting tools and guidelines and to promote good practice. Working in a collaborative manner has the twin benefits of reducing the overall cost of the work and allowing for wider input and review of the project outcomes. This section outlines key areas of focus in 2019.
Brexit
The Environment and External Affairs teams have been monitoring and engaging with government to represent industry’s views on the potential impacts of a no-deal Brexit scenario. This period is a challenging time for industry as EU consultations continue which may influence the environmental management practices of the UKCS post-Brexit. To ensure the best outcome for the UKCS in either Brexit scenario, OGUK continues to liaise with the EU and via IOGP on applicable consultations.

Energy Transition
It is recognised that while there will be a transition to renewable energy sources over the coming years, indigenous oil and gas production will still be required to support the UK’s energy needs. The Climate Change Committee issued *Net Zero – The UK’s contribution to stopping global warming* in May 2019, a report which reassesses the UK’s long-term emissions targets and the potential to meet net-zero greenhouse gas emissions by 2050. OGUK responded to the CCC report and is supportive of net-zero ambition. The industry has an important and constructive role to play in supporting the UK economy in the transition. OGUK is enabling collaboration within industry to facilitate discussions and enable the sharing of good practice initiatives on emissions reductions.

Oil Spill Response
In 2019, the Oil Spill Response Forum was re-focused as a Technical Group to enable the progression of the challenges facing the industry. Six workstreams were identified during the first meeting in 2019, including dispersant application, environmental sensitivities, oil spill modelling, waste and wildlife management and resource sharing.

Guidelines
Throughout 2018 and 2019, the environmental guideline documents published on the OGUK website have been reviewed and re-issued. These documents are used worldwide and cover a wide range of topics providing support to the industry on specific topics such as fisheries liaison, seabed surveys and oil spill response implementation guides.18

Management of Radioactive Substances
The Radiological Issues Technical Group has had a primarily monitoring brief this year following the work last year on the transposition of the Euratom Basic Safety Standards Directive (BSSD) into UK legislation. The implementation of new radiological regulation to offshore activities has yet to be completed; the group has delayed the development of industry good practice on some of the legislation’s new requirements until the required updates to the relevant statutory instruments are made. Following a request during the consultation on transposition of BSSD last year, the group has been co-ordinating the industry response to the Department for Environment, Food and Rural Affairs (DEFRA) consultation on management of radioactive liquids.

Implementation of EU Directives and Best Available Technology Reference Documents (BREFs)
OGUK’s Atmospherics Technical Group continues to engage with OPRED on the outcomes of the Large Combustion Plant (LCP) BREF exhaust stack emission monitoring and the derogation process for deviation from the Associated Emission Levels outlined in the BREF. Both the LCP and Medium Combustion Plant Directive (MCPD) requirements have been translated into UK legislation through the Offshore Combustion Installations (Pollution Prevention and Control) Regulations.

While not linked to the implementation of a specific EU Directive, the European Commission established a technical working group (TWG) in 2015 to develop a Hydrocarbons BREF (which later became a Best Available Technique [BAT] Guideline) covering environmental aspects of all stages of the hydrocarbon exploration and production process. This guideline proposes risk management approaches and BATs for the implementation on the UKCS. The EU Commission published this document in April 2019.

18 OGUK Guidelines available at oilandgasuk.co.uk/guidelines/
During 2018 the EU Commission commenced a review of the implementation of the Offshore Safety Directive. OGUK submitted a response to the public consultation and continues to liaise with the Commission on related topics, such as the migration of biogenic and thermogenic methane from wells. The Commission is currently drafting a report which will be reviewed by the EU Parliament after summer 2019, detailing any recommendations for changes to the directive.

Further Consultations and Regulator Engagement
OGUK continues to co-ordinate industry responses to consultations, including the regulations associated with EU-ETS Phase IV, the Carbon Leakage List 2020–2031, 31st Licensing Round and the *Measuring Environment Change – draft Indicators framework for the 25-Year Environment Plan*. The association is currently reviewing consultations on carbon pricing and microplastics, whilst continuing to monitor the various regulators and advisory bodies for consultations relevant to our membership.

OGUK facilitated consultations between OPRED and industry on regulatory guidance documents including EU ETS Civil Sanctions Guidance and the implementation of the National Implementation Measures (NIMs) benchmarking for Phase IV of ETS.

In early 2018, OGUK and its members supported the European Oilfield Speciality Chemicals Association (EOSCA) in a call for data to help understand and quantify the potential discharge of microplastics in the marine environment, in response to an ECHA consultation on a restriction of intentionally added microplastics. As part of the industry response, OGUK supported a proposal made to OSPAR OIC in 2019 to change the HCNOF chemical registration forms to include the identification of substances containing polymers and microplastics. In 2019, we have continued to engage with ECHA on this topic, via IOGP and EOSCA. Focus has been on ensuring that existing industry controls on the discharge of all offshore chemicals are properly understood by the Commission, and that a practical and objective definition of microplastics is included in the legislation.

Efficiency Improvements
Improving efficiency in oil and gas production is an area of important focus for the UK industry to reduce costs and improve competitiveness. OGUK’s Environment Technical Groups and associated work groups continue to look for opportunities for standardising and simplifying approaches in several areas of environmental management.

An Environment Audit Workgroup was established to streamline environmental audits of common service companies. Standard audit templates have been published for six focus areas (F-Gas, hose management, waste, chemicals, oil spill response and health, safety & environmental management systems) to undertake audits, and to share the report to the relevant operators, thereby minimising the impact on the service company. This group will continue through 2019.

The Seabed Survey Group has also published the *Seabed Survey Guidelines* in 2019. This document provides a consistent approach to undertake seabed surveys for a variety of activities.

The Chemicals Technical Group (formerly the Drilling Fluids Technical group) had a proposal to streamline the process for cementing jobs accepted and implemented in 2019. OPRED has modified the energy portal permitting process to implement this. At the same time, another industry proposal to rationalise the permitting of PLONOR chemicals was implemented.
### Glossary

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Definition</th>
</tr>
</thead>
<tbody>
<tr>
<td>BAT</td>
<td>Best Available Technique</td>
</tr>
<tr>
<td>BEIS</td>
<td>Department for Business, Energy and Industrial Strategy</td>
</tr>
<tr>
<td>boe</td>
<td>barrels of oil equivalent</td>
</tr>
<tr>
<td>BREF</td>
<td>BAT Reference</td>
</tr>
<tr>
<td>Bunding</td>
<td>A retaining wall for safety or environmental purposes.</td>
</tr>
<tr>
<td>Bq</td>
<td>Becquerel</td>
</tr>
<tr>
<td>CEFAS</td>
<td>Centre for Environment, Fisheries and Aquaculture Science</td>
</tr>
<tr>
<td>CFC</td>
<td>Chlorofluorocarbons</td>
</tr>
<tr>
<td>CH₄</td>
<td>Methane</td>
</tr>
<tr>
<td>CHARM</td>
<td>Chemical Hazard and Risk Management model</td>
</tr>
<tr>
<td>CO</td>
<td>Carbon monoxide</td>
</tr>
<tr>
<td>CO₂</td>
<td>Carbon dioxide</td>
</tr>
<tr>
<td>CO₂ₑ</td>
<td>CO₂ equivalent</td>
</tr>
<tr>
<td>Condensate</td>
<td>A natural gas liquid with a low vapour pressure that generally occurs in association with natural gas.</td>
</tr>
<tr>
<td>CRC</td>
<td>Carbon Reduction Commitment</td>
</tr>
<tr>
<td>DEFRA</td>
<td>Department for Environment, Food and Rural Affairs</td>
</tr>
<tr>
<td>DLE</td>
<td>Dry Low Emission</td>
</tr>
<tr>
<td>ECE</td>
<td>Environmental Critical Elements</td>
</tr>
<tr>
<td>EEMS</td>
<td>Environmental Emissions Monitoring System</td>
</tr>
<tr>
<td>ENVID</td>
<td>Environmental Impact Identification</td>
</tr>
<tr>
<td>EOR</td>
<td>Enhanced Oil Recovery</td>
</tr>
<tr>
<td>EU ETS</td>
<td>EU Emissions Trading System</td>
</tr>
<tr>
<td>F-gases</td>
<td>Fluorinated gases</td>
</tr>
<tr>
<td>Flaring</td>
<td>The controlled burning of natural gas in the course of oil and gas production operations.</td>
</tr>
<tr>
<td>Fuel Gas</td>
<td>Gas used in power generation offshore.</td>
</tr>
<tr>
<td>Fugitive emissions</td>
<td>Emissions due to weeps, seeps and leaks.</td>
</tr>
<tr>
<td>GC-FID</td>
<td>Gas Chromatography – Flame Ionisation Detector</td>
</tr>
<tr>
<td>GHG</td>
<td>Greenhouse gases</td>
</tr>
<tr>
<td>GIS</td>
<td>Geographic Information System</td>
</tr>
<tr>
<td>HFCs</td>
<td>Hydrofluorocarbons</td>
</tr>
<tr>
<td>HMCS</td>
<td>Harmonised Mandatory Control Scheme</td>
</tr>
<tr>
<td>HSE</td>
<td>Health and Safety Executive</td>
</tr>
<tr>
<td>IED</td>
<td>Industrial Emissions Directive</td>
</tr>
<tr>
<td>Acronym</td>
<td>Definition</td>
</tr>
<tr>
<td>---------</td>
<td>------------</td>
</tr>
<tr>
<td>IOGP</td>
<td>International Association of Oil and Gas Producers</td>
</tr>
<tr>
<td>LCP</td>
<td>Large Combustion Plant</td>
</tr>
<tr>
<td>Loss of containment</td>
<td>An unplanned or uncontrolled release of hydrocarbon or other substance from primary containment.</td>
</tr>
<tr>
<td>N₂O</td>
<td>Nitrous oxide</td>
</tr>
<tr>
<td>NORM</td>
<td>Naturally occurring radioactive materials</td>
</tr>
<tr>
<td>NOₓ</td>
<td>Nitrogen oxides</td>
</tr>
<tr>
<td>OCNS</td>
<td>Offshore Chemical Notification Scheme</td>
</tr>
<tr>
<td>OGA</td>
<td>Oil and Gas Authority</td>
</tr>
<tr>
<td>OPEP</td>
<td>Oil Pollution Emergency Plan</td>
</tr>
<tr>
<td>OSPAR</td>
<td>The Oslo and Paris Convention for the protection of the marine environment of the North East Atlantic</td>
</tr>
<tr>
<td>PEC</td>
<td>Predicted Environmental Concentration</td>
</tr>
<tr>
<td>PFCs</td>
<td>Perfluorocarbons</td>
</tr>
<tr>
<td>PHE</td>
<td>Public Health England</td>
</tr>
<tr>
<td>PLONOR</td>
<td>Pose Little Or NO Risk – used by OSPAR to classify substances used and discharged offshore.</td>
</tr>
<tr>
<td>PNEC</td>
<td>Predicted No Effect Concentration</td>
</tr>
<tr>
<td>PON1</td>
<td>Petroleum Operations Notice</td>
</tr>
<tr>
<td>Produced water</td>
<td>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.</td>
</tr>
<tr>
<td>Production efficiency</td>
<td>The total annual production divided by the maximum production potential of all fields on the UKCS.</td>
</tr>
<tr>
<td>REACH</td>
<td>Registration, Evaluation, Authorisation and Restriction of Chemicals</td>
</tr>
<tr>
<td>SF₆</td>
<td>Sulphur hexafluoride</td>
</tr>
<tr>
<td>SO₂</td>
<td>Sulphur oxides</td>
</tr>
<tr>
<td>SUB</td>
<td>SUB chemicals are those classified under OCNS as harmful and should be phased out and substituted with a less harmful substance.</td>
</tr>
<tr>
<td>UKCS</td>
<td>UK Continental Shelf</td>
</tr>
<tr>
<td>Venting</td>
<td>The controlled release of gases into the atmosphere in the course of oil and gas production operations.</td>
</tr>
<tr>
<td>VOCs</td>
<td>Volatile Organic Compounds</td>
</tr>
<tr>
<td>Well stream fluids</td>
<td>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).</td>
</tr>
</tbody>
</table>