

OGUK

**ENVIRONMENT
REPORT 2021**





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¹ These differences are acceptable as EEMS returns can be updated after year end in discussion with the regulator in the event corrections are required.

ENVIRONMENT REPORT 2021

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Welcome to OGUK's 2021 *Environment Report*, which provides an update on the environmental performance of the UK offshore oil and gas industry to the end of 2020. The report analyses and interprets data gathered by the Offshore Petroleum Regulator for Environment and Decommissioning (OPRED), and covers discharges to sea, accidental oil and chemical releases, and waste disposal. Emissions to atmosphere are covered in OGUK's *Energy Transition Outlook*, which was published in October.

It also summarises the activities of OGUK groups and the OGUK Health, Safety & Environment (HSE) Team undertaken in 2021. This work has a number of aims: supporting the development of new environmental legislation and guidance; sharing lessons and good practice; raising efficiency and supporting the move to a net-zero economy; and working with members and stakeholders to maintain our social licence to operate.

Direct emissions from the UK oil and gas sector are being driven down with a 2 million tonne reduction in 2020, around half of which OGUK estimates can be attributed to operators' actions.

The industry will continue to reduce emissions as part of the North Sea Transition Deal (NSTD), which will accelerate the energy transition towards new technologies, cutting emissions even as the sector continues to

supply ongoing oil and gas requirements. New activities will grow the supply chain and stimulate jobs and opportunities for communities across the UK. A specific objective is to maximise the contribution of the sector in bringing carbon capture and hydrogen production on stream quickly. This will, in turn, support other UK industries as they transition to net zero.

Over the past year, key areas of focus include oil spill response and improved emissions monitoring, along with monitoring the implications of Brexit and continued engagement with the regulator whilst ensuring the pandemic has minimal impact on operations. OGUK's HSE team has been in constant contact with its members, government and other stakeholders to safeguard energy supply and ensuring environmental risk management was unaffected during the pandemic by developing a suite of documents covering aviation, medical, logistics and workforce engagement/safety management. COVID-19 meant that 2020 saw the lowest production since 2015 (588 million barrels of oil equivalent (mm boe) and a drop in personnel on board (PoB), with average PoB dropping to around 7,500 from 12,500. Analysis of the 2020 data shows industry delivering stabilised environmental performance across the performance indicators.

The mass of chemicals discharged decreased by 17%, and 72% of all chemicals discharged under permit were defined as 'posing little or no risk' (PLONOR).

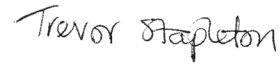
Foreword continued

The concentration of oil discharged with produced water increased to 17.8 from 16.9 mg/litre (mg/l). This was the fifth consecutive year of increases, but still well below the 30 mg/l threshold set by OSPAR. However, total produced water discharges decreased 8% year on year, from 140mn m³ to 129mn m³; and the total mass of dispersed oil discharged decreased by 3% to 2,234 tonnes, bucking the three-year trend of year-on-year increases.

Last year, there was a fractional decrease in waste generated of 1.14%, and the amount sent to landfill decreased by 28%.

In unintentional releases, a single diesel release incident accounted for 89% of the total mass released in 2020, with 239 tonnes from a total of 268 tonnes. This one-off event meant that the total amount of oil unintentionally released was nine times higher in 2020 than in 2019. The total annual unintentional release mass is historically susceptible to single large releases. But it is worth noting that excluding this single release, unintentional releases of oil would have remained comparable to “normal” years, with 30 tonnes compared to 26 tonnes in 2019. The unintentional release of chemicals decreased by 61% by mass compared with 2019.

During what was a challenging period for this sector, we did not lose sight of our responsibilities for good environmental management and compliance and that has been demonstrated by the performance captured in this report. We hope you find it helpful and informative. Any queries should be directed to OGUK’s HSE Director at: tstapleton@oguk.org.uk.




Trevor Stapleton
Health, Safety and Environmental Director
OGUK

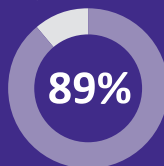
2. Key findings

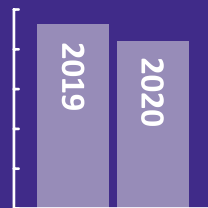
Unintentional releases


The largest single chemical release totalled **32** tonnes, which was methanol, and the largest single oil release was **239** tonnes of diesel.

 **61%** The total mass of unintentional chemical releases decreased by 61% from **309** tonnes in 2019 to **122** tonnes in 2020.

 **x10** The total mass of unintentional oil releases was ten times higher, up from **26** tonnes in 2019 to **268** tonnes in 2020. But most (89%) of the mass of unintentional oil release occurred in one release incident. And the number of unintentional oil release incidents dropped to **200** from **215** in 2019.




 **9%** The total number of releases was down from 2019, with **420** in 2020 compared with **462**.



 The average unintentional oil release mass rose from **0.1** tonnes in 2019 to **1.3** tonnes in 2020. This too was due to the single **239**-tonne release.

 The average unintentional chemical release mass decreased from **1.4** tonnes in 2019 to **0.6** tonnes in 2020.

 There was a significant decrease in crude releases, from **10** tonnes in 2019 to **2** tonnes in 2020, and in hydraulic oil releases, from **9** tonnes in 2019 to **1** tonne in 2020.

Produced water

 Volume of produced water discharged to sea decreased in 2020, down **8.15%** year on year. The UKCS reinjected more produced water than in previous years, with **37%** of the total produced going back to the reservoir.

 The mass of discharged oil decreased by **3%**, from **2,297** tonnes to **2,234** tonnes, bucking the three-year trend of year-on-year increases. The concentration increased to **17.8** mg/l from **16.9** mg/l, rising for the fifth consecutive year but still well below the **30** mg/l threshold set by OSPAR. 

2. Key findings continued

Discharges - Chemicals



There was a **17%** decrease in chemicals discharged to sea under permit in 2020. This decrease primarily related to pipeline chemicals discharges, which decreased **80%** from **2,905** tonnes to **594** tonnes.

There was a 13% decrease in chemicals discharged to sea under permit per unit of production in 2020 from **197** to **171** tonnes/mm boe.



72% of all chemicals discharged under permit posed little or no risk (PLONOR), equivalent to **72,476** tonnes of the total discharged.

410 different SUB chemicals were discharged from all activities in 2020, constituting **7%** of the total. This is an increase of **1,402** tonnes, from **5,678** tonnes in 2019 to **7,080** tonnes in 2020.

Wastes

There was a small decrease in waste generated in 2020, down **1.1%** compared to 2019, with **180,995** tonnes in 2020 compared to **183,082** tonnes in 2019.

Similar to last year, **39%** of waste was re-used or recycled.



Other discharges - NORM and Drill Cuttings

Discharged fluids decreased, as did activity. This is reflected in the number of wells spudded, down from **158** in 2019 to **74** in 2020.



There was a **31%** decrease in discharged cuttings to **35,784** tonnes, from **52,147** tonnes in 2019.

Naturally occurring radioactive materials (NORM) including isotopes of lead and radium are discharged to sea in produced water. The total mass discharged to sea in 2020 decreased by **30%**, although the breakdown is a mixed picture, with a **68%** increase in Pb-210, a decrease of **37%** in Ra-266 and a decrease of **33%** in Ra-288.

The concentration of NORM in discharged water decreased from **0.0037** Bq/ml in 2019 to **0.0030** Bq/ml in 2020, well below the notifiable threshold of **0.1** Bq/ml.

The proportion of waste going to landfill was **18%**, down from **24%** in 2019 and the lowest proportion in the past decade, with a **20%** decrease since 2010.



3. Permitted Offshore Emissions and Discharges

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 technically challenging. In recent years the industry has improved production efficiency and reduced the associated costs of oil and gas operations while minimising the risk of environmental harm.

The Offshore Petroleum Regulator for Environment and Decommissioning (OPRED), part of the Department for Business, Energy & 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 waste generated by upstream oil and gas operations.

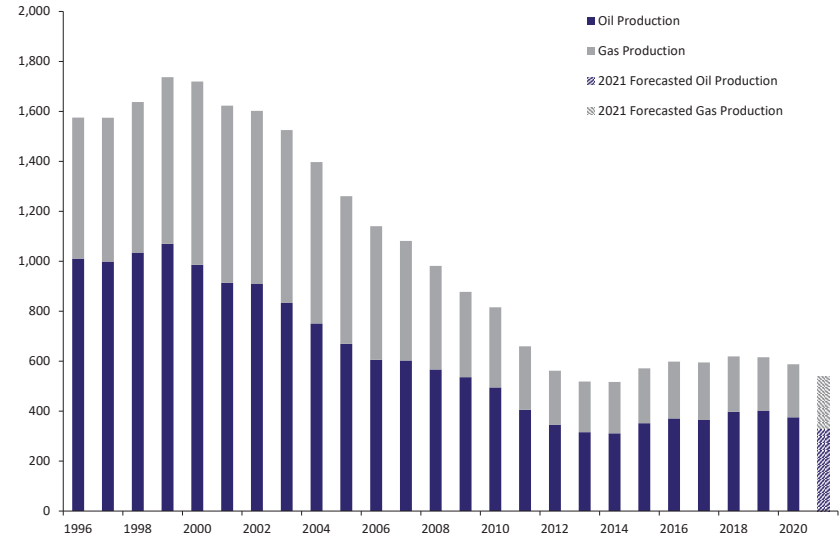
3.1 UKCS Activity

Production in the basin has remained relatively flat year on year, and 2020 production aligned with the trend seen pre-2018, decreasing slightly to

588mm boe. 2018 recorded a slight increase of 4% from 2017 and 2019 production matched that in 2018. 2020 UKCS production efficiency was maintained at 80%, which is in line with 2019. 2021 gas production was down by 27.3% [from 111.88mm boe to 81.29mm boe] while oil production was down 20.3% from 199.73mm boe to 159.24mm boe].

Figure 1 shows the historic and forecast oil and gas production.

Figure 1: Historic and Forecast Production



3. Permitted Offshore Emissions and Discharges *continued*

3.2 Produced Water

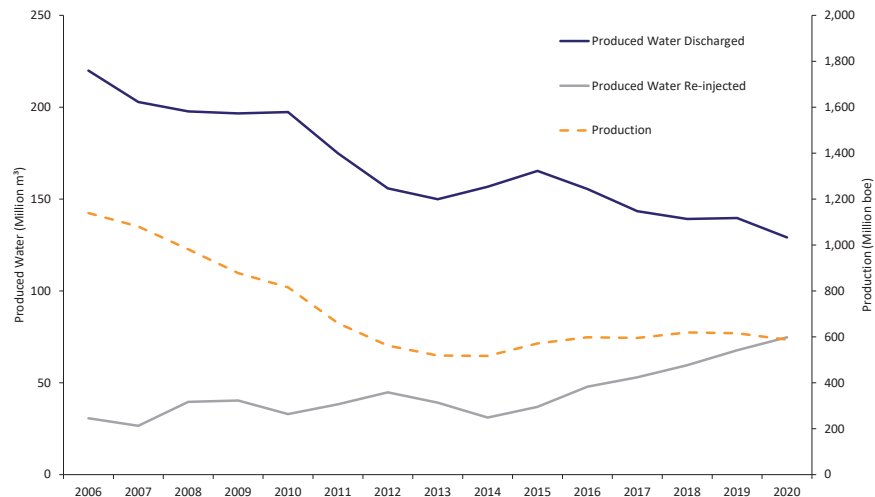
When oil and gas are produced, water within the hydrocarbon reservoir is also brought to the surface. This produced water can make up over 95% of produced liquids in some fields. It is separated from the hydrocarbons before either being re-injected into the reservoir to maintain production or treated and discharged to sea. Operators may apply to OPRED for a permit to discharge produced water.

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 2). Over time, however, the decline in production has been greater than the decrease in produced water generated as hydrocarbons become harder to extract and so more water is produced.

In 2020, UKCS production decreased for the first time since 2014 and the amount of produced water discharged to sea followed this trend, dropping to 129mn m³ in 2020, from 140mn m³ the year before. The amount of produced water re-injected to the subsurface, however, increased from 68mn m³ in 2019, to 75mn m³ in 2020.

Figure 2: Total Produced Water Discharged to Sea and Re-injected versus Production



Source: EEMS, May 2021; OGA

3. Permitted Offshore Emissions and Discharges *continued*

Produced Water Composition

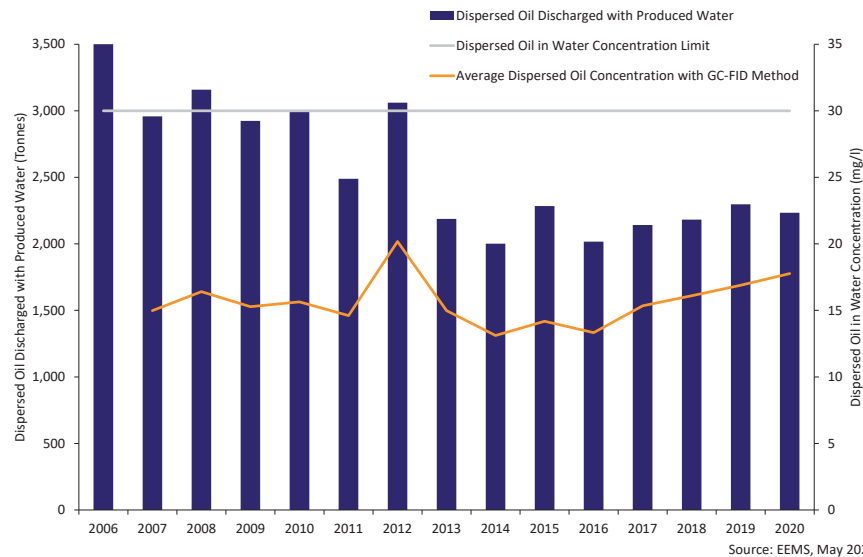
Produced water collects small amounts of naturally occurring substances through contact with the reservoir rock, including dispersed oil, dissolved organic compounds, NORM as well as production chemicals injected during the process. The composition of produced water is determined by the reservoir geology, maturity and stage of production life.

Dispersed Oil in Produced Water

As shown in Figure 3, around 2,234 tonnes of dispersed oil were discharged to sea with produced water in 2020, making up just over 0.001% of the total mass of produced water, in line with the previous five years. The total mass of oil discharged decreased by 3% from 2019.

OSPAR Recommendation 2001/1 limits individual installations to an average dispersed oil-in-water concentration of 30 mg/l. In 2020, the average concentration across industry was 17.8 mg/l, up from 16.9 mg/l in 2019. At such low concentrations, oil rapidly disperses and is quickly broken down by naturally occurring bacteria.

Figure 3: Oil Discharged to Sea with Produced Water



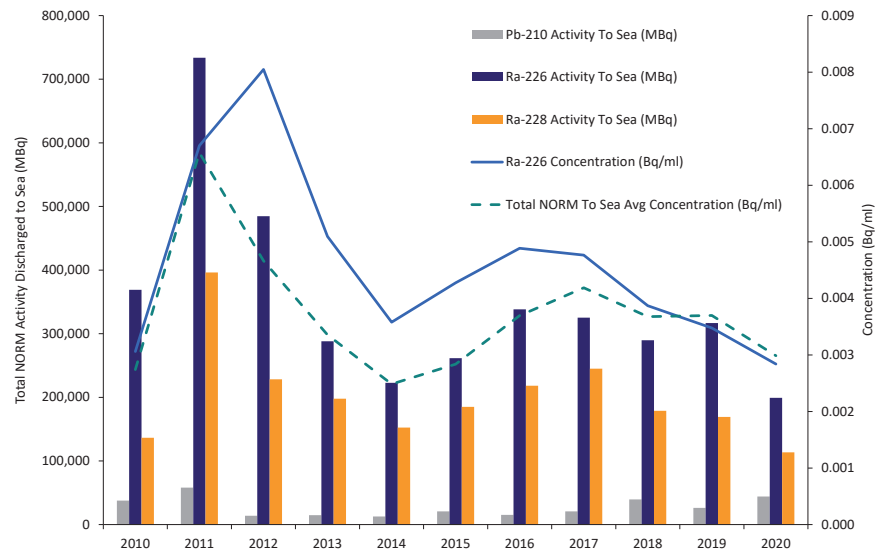
3. Permitted Offshore Emissions and Discharges *continued*

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 contain 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 regulated by permits issued under the Radioactive Substances Act (RSA) 1993. These oblige the operator to notify the relevant environment agency if the concentration of Ra-226 is greater than 0.1 Bq/ml.

There was a 30% decrease in the total NORM activity (Pb-210, Ra-228, Ra-226) discharged to sea compared with 2019. How much NORM is discharged depends 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.

Figure 4: Breakdown of NORM Discharged in Produced Water



Source: EEMS May 2021

3. Permitted Offshore Emissions and Discharges *continued*

CASE STUDY: Augean North Sea Services

Removal, treatment and discharge of contaminated water and washings from assets and vessels in the North Sea has proved costly and environmentally challenging. Previously, thousands of cubic metres of materials had to be trucked to Teesside for this purpose. Augean North Sea Services operations and HSEQ teams considered its infrastructure in the north east of Scotland and worked with ARPS to permit its Greenbank Waste Management Centre in Tullos, Aberdeen, for this purpose (*see image, from Augean*).

Starting with a major decommissioning project at Dundee in 2019, more than 1,000 cubic metres of NORM, NORM bund water and separation fluids were successfully discharged, without the need for excessive transportation. Since the original permit was put in place, the total volume of NORM water processed locally is over 1,500 cubic metres, resulting in a substantial reduction in associated carbon emissions.

The process at Augean's Tullos site involves treatment of the water through diffuse air filtration (DAF), followed by treatment chemical dosing to remove heavy metals, NORM isotopes, oils and solids to

meet Scottish Water's discharge criteria. The permitted facility is also now capable of handling a variety of waste waters, including produced water.

To support this, an EASR permit has been obtained from SEPA for Augean's Pocra Quay facility, which holds a 1500 cubic metre tank farm. This can support the direct discharge of significant volumes of NORM contaminated water from a PSV, further reducing the requirement to transport these waste waters south of the border.



3. Permitted Offshore Emissions and Discharges *continued*

3.3 Chemicals

The offshore oil and gas industry uses chemicals in the exploration and production of hydrocarbons. Their use is restricted 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 pose little or no risk 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. The UK approach to the reporting of chemical discharges is based on a "worst-case" scenario rather than actual quantities released.

Mass of Chemicals Discharged

In 2020, just over 100,700 tonnes of chemicals were discharged to sea (171 tonnes/mm boe produced). 64% of this (64,400 tonnes) came from drilling activities; 35% (35,700 tonnes) from production-related activity; and the rest (600 tonnes) was pipeline chemicals.

Most of the mass of chemicals discharged is 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 37%, in line with the reduction in drilling activity over this period. The spike in 2013 (*see Figure 5*) is due to more complex wells, needing more chemicals. The subsequent drop in drilling chemicals discharged in 2020 mirrors the decrease in drilling activities seen during the pandemic.

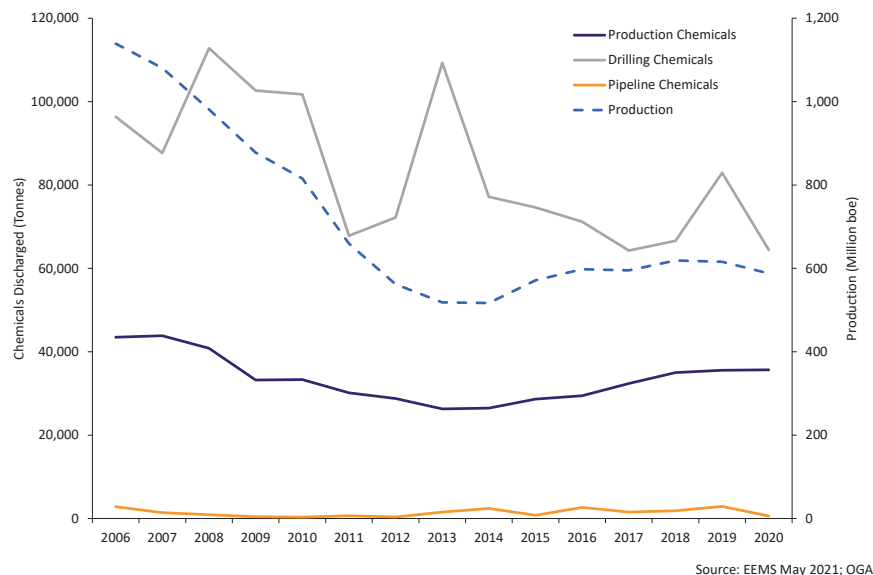
Although UKCS production has been in decline since 2000, the use of production chemicals has tracked a more gradual slope as the basin's increasing maturity means more chemicals are needed to improve recovery rates. However, the permitted discharge of production chemicals has lessened over the past two years, from a 2,600-tonne increase in 2018, to a 600-tonne increase in 2019, and a 90-tonne increase in 2020.

Chemicals used for pipeline maintenance are designed to prevent corrosion or scale build-up. As shown in Figure 5, the amount discharged decreased

3. Permitted Offshore Emissions and Discharges continued

significantly in 2020, to 600 tonnes, and accounted for 1% of total chemicals discharged. As with drilling activity, pipeline works will fluctuate from year to year and chemical discharge will largely reflect this.

Figure 5: Production, Drilling and Pipeline Chemicals Discharged



Composition of Chemicals Discharged

In 2020, 71% of chemicals discharged to sea from offshore oil and gas operations were PLONOR and 7% were SUB chemicals. Operators were obliged to phase out, where practical, the use of all SUB chemicals by the end of 2017². A review of the OSPAR Recommendation 2006/03³ *Chemicals that are or contain Substances Identified as Candidates for Substitution*, was undertaken as part of the Offshore Industry Committee meeting held in March 2019. This resulted in a new recommendation that would enable the phase-out programmes to continue.

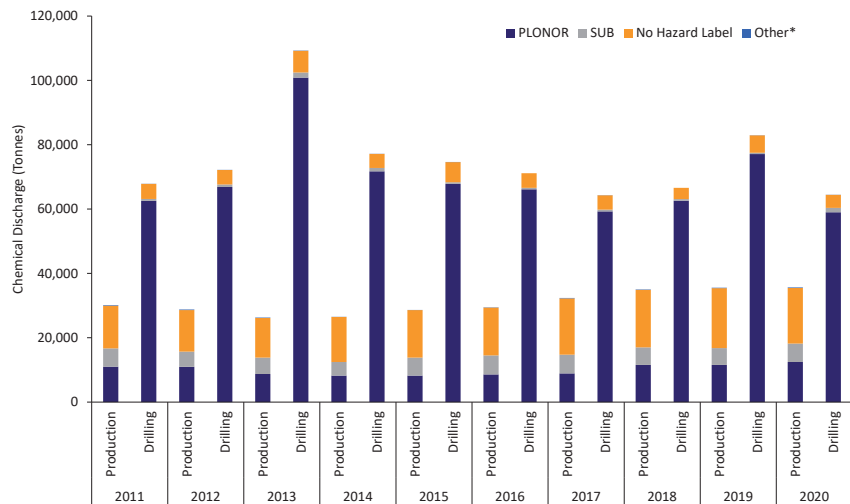
Last year the volume of SUB chemicals discharged to sea rose by 25%, while there was an overall decrease of 17% of all chemicals. A quarter of the SUB chemicals reported were due to well stimulation activities on a single campaign that used products that in real-world situations would not release the SUB listed substance in the high quantity reported.

² See <http://www.ospar.org/documents?v=7336>

³ Environmental Goals for the Discharge by the Offshore Industry of Chemicals that Are, or Which Contain Substances Identified as Candidates for Substitution.

3. Permitted Offshore Emissions and Discharges continued

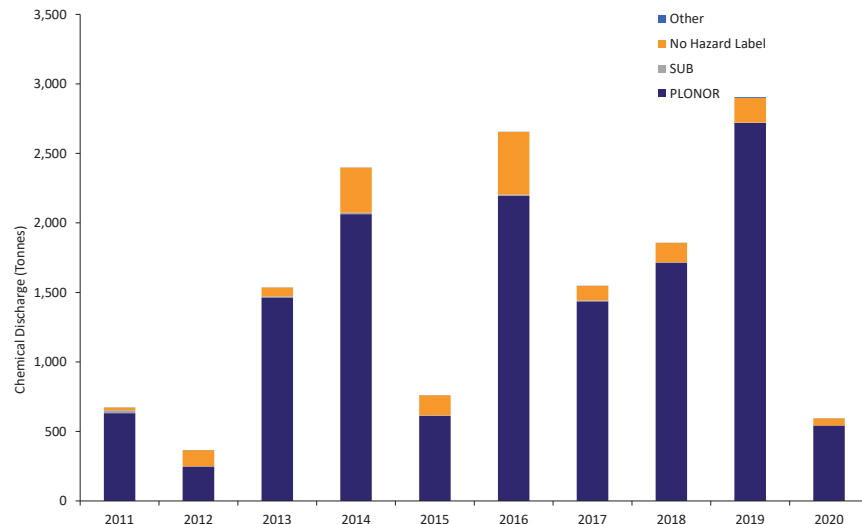
Figure 6: Breakdown of Drilling and Production Chemicals Discharged by Classification



*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 2021

Figure 7: 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 2021

3. Permitted Offshore Emissions and Discharges *continued*

3.4 Drill Cuttings

Drill cuttings are fragments of rock broken off 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 are disposed of according to the fluid type used to drill.

Water-based fluid drill cuttings pose a lower environmental hazard and are generally permitted for discharge to sea. Oil-based fluid cuttings may only be discharged to sea after the oil-on-cuttings content has been reduced to less than 1% 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 that the discharged cuttings might pose.

As with drilling chemicals, the mass of cuttings discharged to sea correlates closely to drilling activity. At 35,784 tonnes, 2020 saw less discharged than in previous years. With 204 kilometres drilled on the UKCS in 2020, this discharge represents 175 tonnes/km drilled. The peak in 2013 (*shown in Figure 8*) is due to more complex wells being drilled.

Of the 25,000 tonnes of cuttings coated with water-based fluids, fewer than 1% were returned to shore for treatment and disposal, with the rest discharged to sea or injected as permitted.

Of the 38,000 tonnes of oil-based fluid cuttings, 64% (24,200 tonnes) were returned to shore for treatment, down 6 percentage points from 2019. Around 10,925 tonnes were thermally treated offshore to reduce their oil content to below 1% and discharged to sea, while the remainder were injected into the reservoirs.

Figure 8: Drill Cuttings Discharged to Sea



Source: EEMS, May 2021, OGUK

3. Permitted Offshore Emissions and Discharges *continued*

3.5 Atmospheric Emissions

Producing, treating and exporting hydrocarbons all give rise to atmospheric emissions. Activities include combustion to provide electricity to 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 (CO₂), carbon monoxide (CO), methane (CH₄) and oxides of nitrogen (NO_x) and sulphur (SO_x). Small amounts of nitrous oxide (N₂O) are also emitted. Releases of volatile organic compounds (VOCs) and CH₄ may occur during tank loading or from firefighting equipment.

At the start of 2020, OGUK created a new Sustainability Team to focus the industry's attention on a net zero basin. This covers activity ranging from the production of oil and gas and assisting the UK in reducing its total greenhouse gas (GHG) emissions, through to driving the adoption of new technologies. Although emissions reporting was once part of the HSE Team's remit, this now sits with the Sustainability Team as part of wider emissions reduction work streams. It is therefore not part of this year's *Environment Report*.

All the relevant data may be found in this year's edition of *Energy Transition Outlook*, published by OGUK.

CASE STUDY: SNF

In 2017 the OGA defined its Enhanced Oil Recovery (EOR) strategy for the North Sea. This described the long-term benefits of EOR and the expected role it has in support of maximising economic recovery (MER) from the UKCS, delivering an incremental recovery factor of 5%. Alongside wider industry efforts to transition to less carbon-intensive energy sources and reduce greenhouse gas emissions, the application of polymer EOR can help support these targets.

The critical technology for polymer EOR is polyacrylamide. SNF is the leading manufacturer of polyacrylamide and has invested in using a carbon-efficient manufacturing process and supply chain efficiencies, recently constructing a manufacturing plant for EOR polymers in Teesside. This location was chosen to minimise the distance between the production plant and the end-users reducing the CO₂ footprint of logistics. By producing in Teesside instead of Andrezieux (France), the CO₂ emissions related to the polymer transport to Aberdeen is reduced by 35%, or 30 kg of CO₂/tonne of polymer transported.

3. Permitted Offshore Emissions and Discharges *continued*

By applying polymer EOR, produced water volumes can be reduced by up 65%, reducing the energy associated with treatment and disposal. SNF estimates that the use of polymer EOR enables a reduction of CO₂ emissions by around 50%, based on reductions in pumping, treating, and handling water per barrel of oil produced.

Comparing data gathered from numerous polymer EOR applications, CO₂ emissions are estimated to have been reduced by between 50% and 80%, with an average reduction in water use ranging from 60% to 85%.

The journey of polymer EOR in the North Sea is now continued by Ithaca, which has used expanding polymer flooding in its Captain field; and by Equinor positioning polymer EOR in the Mariner field. Orcadian Energy is also considering polymer flooding to reduce the carbon footprint of oil extraction in the Pilot field.

SNF is confident that polymer EOR can positively contribute to reductions in offshore production emissions of 10% by 2025 and a further 50% by 2030 to meet the sector's aim of creating a net-zero basin by 2050. This will, however, only be achieved through close collaboration across the whole supply chain.

3.6 Waste

The EU Waste Framework Directive (2008/98/EC)⁴ defines waste as “any substance or object that the holder discards or intends or is required to discard”. Like any other industry, oil and gas production generates waste that must be disposed of. Waste originates at various points in the life cycle and can be solid or liquid, hazardous or non-hazardous. Waste that is classified as hazardous only presents a risk to the environment if it is incorrectly managed. Modern disposal and recycling techniques, such as engineered landfill, incineration and recovery of waste oils may also improve environmental performance.

Waste needs segregation and appropriate storage on offshore installations before transportation to shore, where a licensed waste contractor processes it. As landfill is costly and unsustainable in the long term, operators segregate waste to reduce what goes to landfill and maximise reuse and recycling.

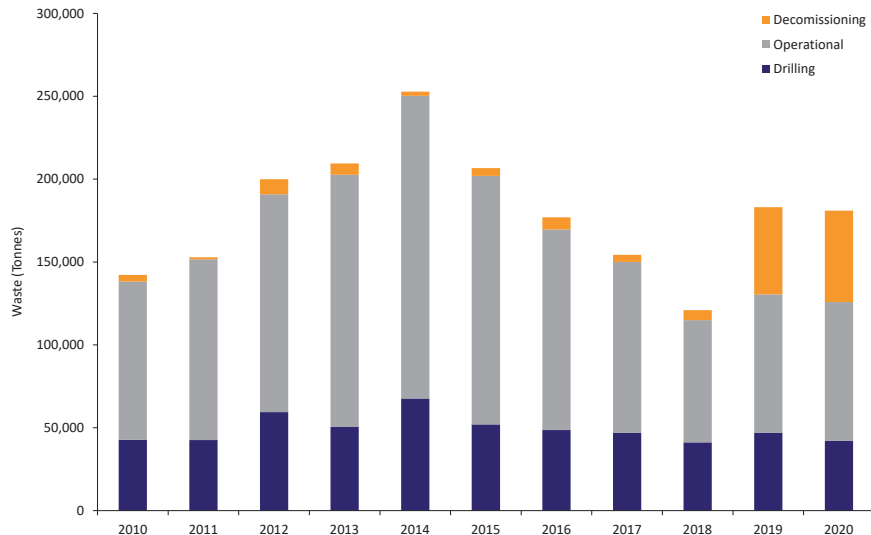
The total amount, as well as the form, of waste generated varies from year to year depending on the levels of exploration, production, maintenance and decommissioning.

⁴ <http://ec.europa.eu/environment/waste/framework/>

3. Permitted Offshore Emissions and Discharges *continued*

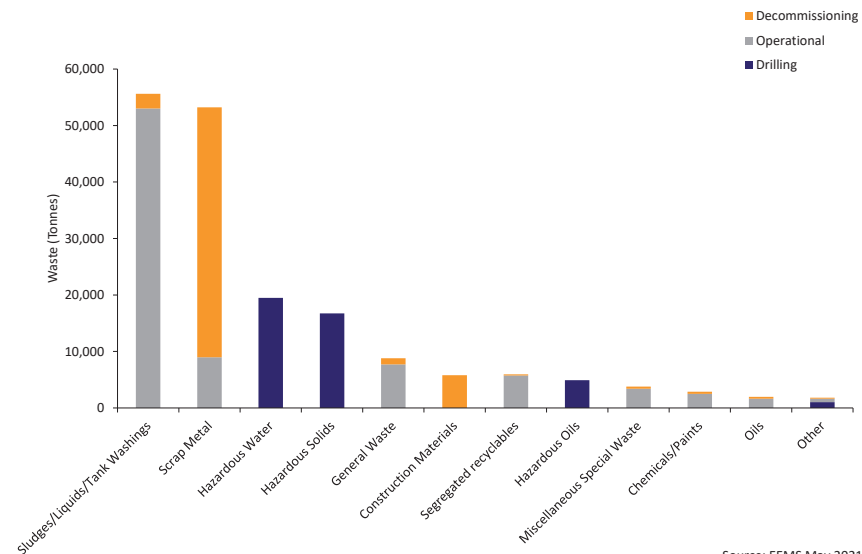
Total waste decreased year on year to 180,995 tonnes in 2020 from 183,082 in 2019 (*see Figure 9*). This was a rise of 60% compared with 2018, which was the lowest in recent years largely because of decommissioning waste rising more than eight times in 2019; and a further 5% in 2020. There was a slight decrease in drilling and operational waste from 2019 to 2020.

Figure 9: Waste Generated by Offshore Activity



Source: EEMS May 2021

Figure 10: Operational and Decommissioning Waste



Source: EEMS May 2021

3. Permitted Offshore Emissions and Discharges *continued*

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.

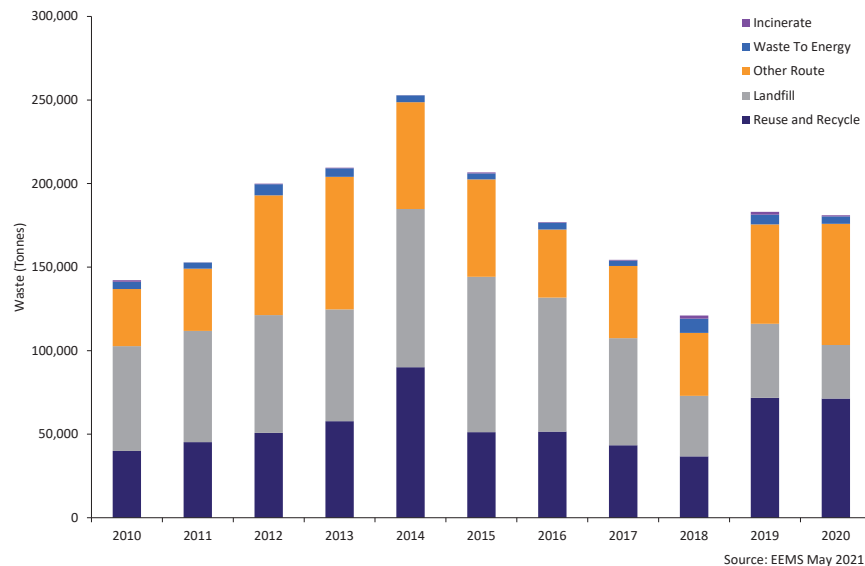
Sludges, liquids and tank washing make up the largest category of waste (30%) disposed of in 2020, with this including the backload of drilling muds.

Figure 10 (*see previous page*) shows the breakdown of waste sources and types.

As shown in Figure 11, 2020 saw about 12,200 tonnes less sent to landfill than 2019, while, similarly to 2019, over 71,000 tonnes of total waste were reused or recycled. Disposal routes categorised as “other” include the treatment of aqueous wastes, composting and land spreading; these routes have seen yearly increases over the past two years, with 74,500 tonnes being disposed of via these methods in 2020 – nearly twice the 2018 amount.

Of the 55,170 tonnes of decommissioning waste generated in 2020, 65% were re-used, recycled or used for power generation.

Figure 11: Total Waste Generated Offshore by Disposal Method



4. Environmental Performance Benchmarking

Each year, OGUK carries out a benchmarking exercise for operators reporting data to EEMS to gain an overview of their individual performance relative to the overall industry. This shows a company's strengths and any weaknesses, with the aim of achieving better industry-wide performance.

The data are anonymised with each company allocated a letter in each category and that letter changing from graph to graph. Each individual operator will be informed of its rankings in each category, but cannot determine the environmental performance of others.

Given the varied scale and types of operations on the UKCS, benchmarked rankings may not truly reflect some individual environmental performances, but they do enable a general understanding.

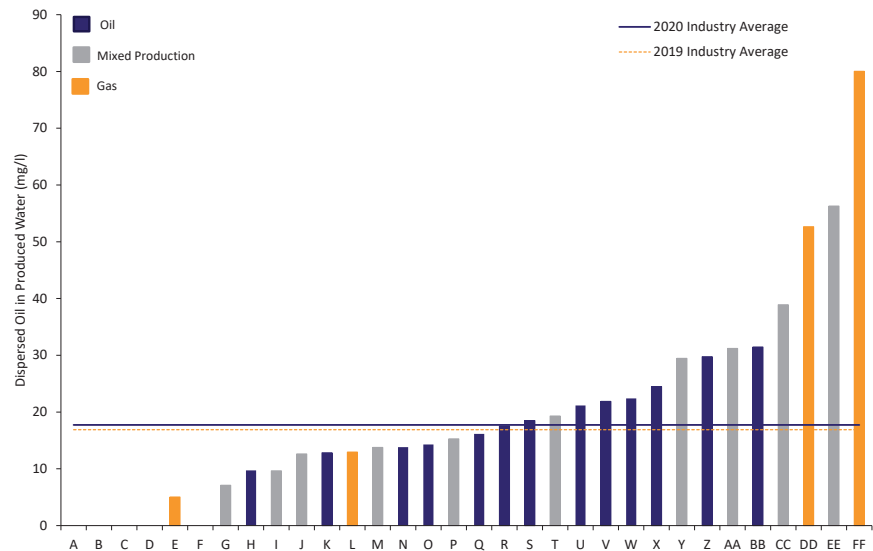
4.1 Oil in Produced Water

The average concentration of oil discharged to sea in produced water across industry increased by 5%, from 16.9 mg/l in 2019 to 17.8 mg/l in 2020. Despite the increase, the average remains below OSPAR's annual recommended limit of 30 mg/l.

Average oil-in-water concentrations for individual operators depend on several factors. Those operators with higher concentrations may have

more gas production or challenging reservoirs, for example. The operator benchmarking illustrated in Figure 12 below therefore provides a general picture of the industry's performance with respect to oil dispersed in water but it does not necessarily mean that some operators perform better than others.

Figure 12: Concentration of Discharged Hydrocarbons in Produced Water by Operator



Source: EEMS, May 2021

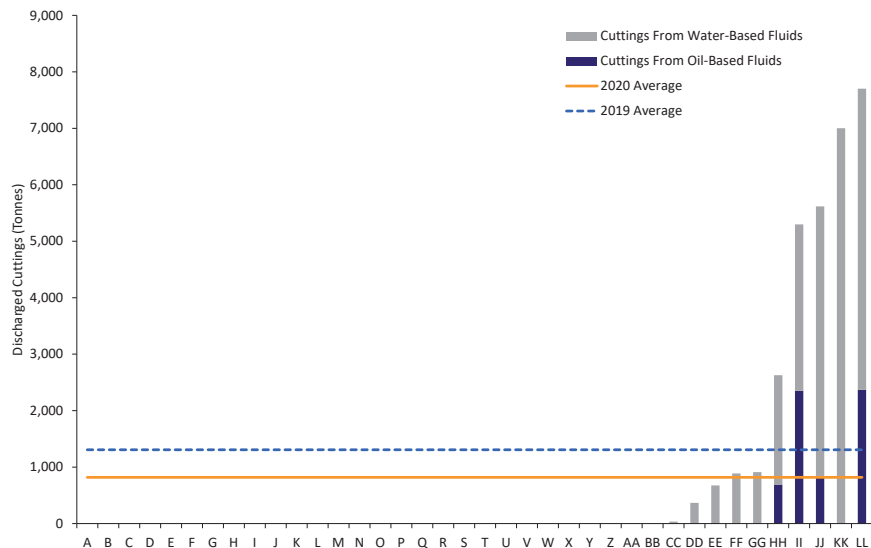
4. Environmental Performance Benchmarking continued

4.2 Discharged Drill Cuttings

Figure 13 shows the distribution of drill cuttings discharged to the sea by UKCS operators in 2020. The amount discharged depends on the number and length of wells a given operator has drilled over the year, and therefore volumes will increase during intensive drilling campaigns. On average, 484 tonnes/well of drill cuttings were discharged to sea in 2020, more than the 330 tonnes in 2019.

Four of the 38 operators discharged oil-based fluid cuttings in 2020, one more than in 2019. All such cuttings undergo processing and cleaning on-board to bring the oil-on-cuttings content below 1%. More oil-based fluid cuttings were discharged to sea in 2020 and less were shipped to shore for further processing and landfill.

Figure 13: Cuttings Discharged to Sea by Operator



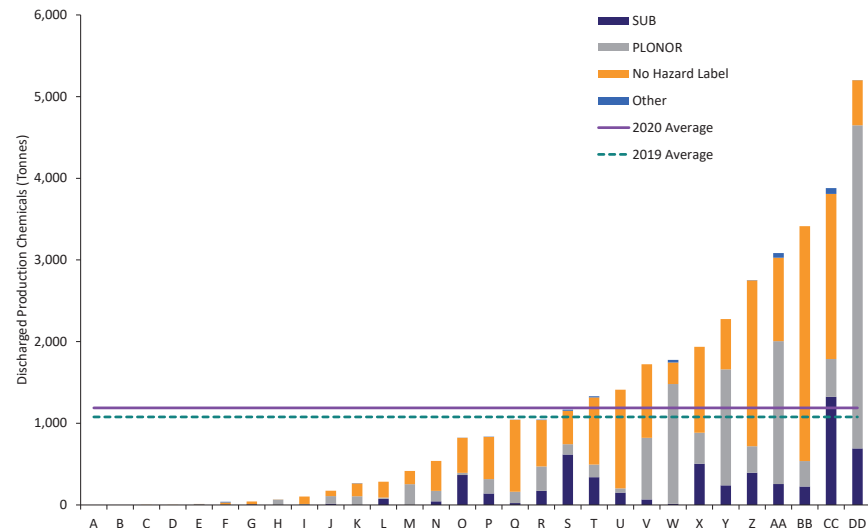
Source: EEMS, May 2021

4. Environmental Performance Benchmarking continued

4.3 Production Chemicals

In 2020 the mass of production chemicals discharged per operator ranged from 0 to just over 5,200 tonnes (see Figure 14). This does not directly correlate to production levels as differing hydrocarbon properties and process conditions dictate how much are used. Overall, the mean amount of chemicals discharged to sea per operator rose in 2020 to 1,200 tonnes, from 1,100 tonnes the year before.

Figure 14: Production Chemicals Discharged to Sea by Operator



*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 2021

5. Accidental Releases

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 eliminate or reduce them. The industry invests in these barriers through maintenance programmes that ensure the integrity of equipment; the provision of multiple physical barriers, such as downhole safety valves, closed drains, and bunding; through the development of handling procedures that minimise the potential for releases; and in staff training and competence management. Through OGUK forums and work groups, its members are encouraged to share experiences from incidents and any lessons that have been learnt.

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

Furthermore, every offshore installation has an oil pollution emergency plan (OPEP), approved by OPRED, which sets 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 any large oil release might reach the shoreline – and if so, where.

5.1 Overview from 2011-20

PON1 data are publicly available on the BEIS website and updated regularly⁵. The following analysis is based on the PON1 dataset from 2011-20. Further analysis has been carried out to categorise PON1 data from this period by product released; hazard category; and source of accidental releases.

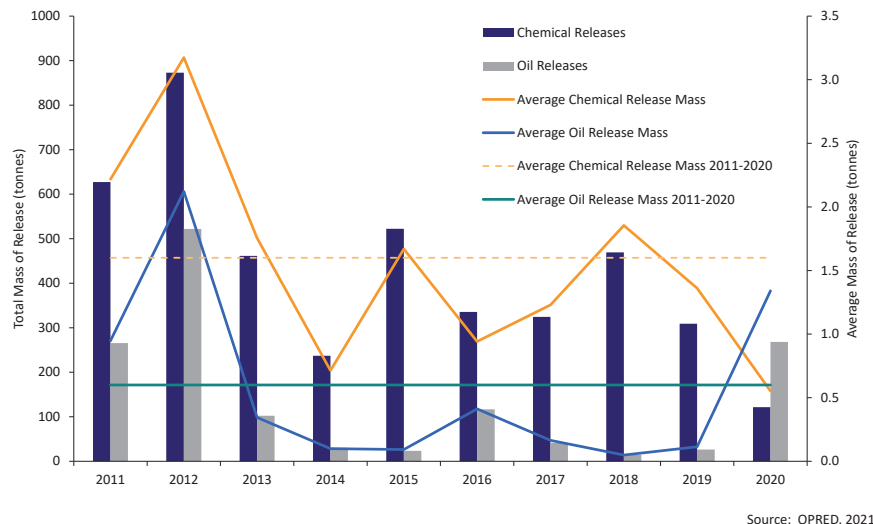
The amount of chemicals and oil accidentally released to the marine environment over the last nine years fluctuates, highlighting the sensitivity of these data to rare but high-mass events (*see Figure 15*). The largest single oil release in 2020 was 239 tonnes, while the largest chemical release was 32 tonnes.

The total mass of chemicals and oil released in 2020 was higher than in 2019, but in line with the fluctuations in trends over the past three years. The total amount of oil and chemicals accidentally released in 2020 is less than the total permitted mass discharged to sea (*see following sections*).

⁵ The BEIS PON1 data are available at http://itportal.decc.gov.uk/eng/fox/pon1/PON1_PUBLICATION_EXTERNAL/viewCurrent

5. Accidental Releases continued

Figure 15: Accidental Chemical and Oil Release Mass



5.2 Accidental Oil Releases

In 2020, there were 200 accidental oil releases on the UKCS, where over 268 tonnes of oil were released to the marine environment. To put this into context, in the same year, about 2,234 tonnes of oil were discharged to sea in produced water, under permit. This means that accidental oil releases represented 12% of the total oil that entered the sea. Given that 80mn tonnes of oil were produced in 2020, accidental oil releases represented less than 0.0003% of total oil production.

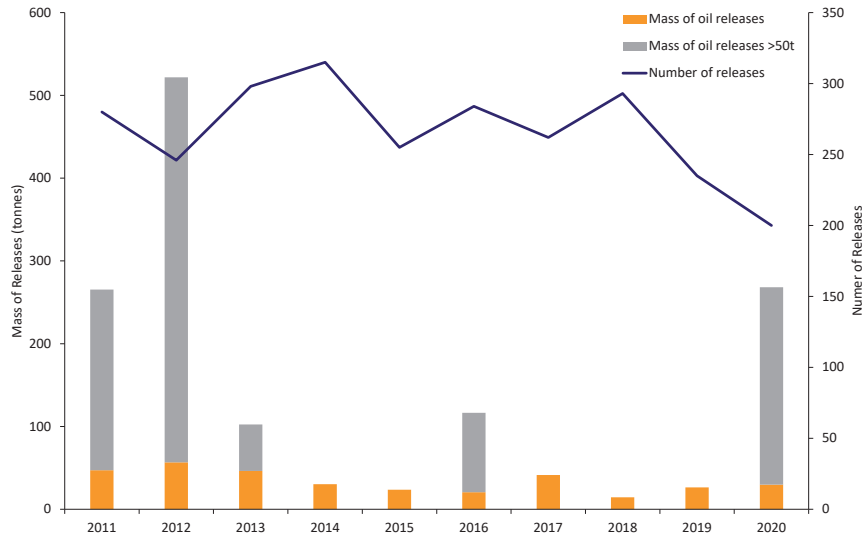
Despite a decrease in the overall number of oil releases from 235 in 2019 to 200 in 2020, the total mass of oil released in 2020 was significantly higher, at 239 tonnes compared with 26 tonnes in 2019. This is due to a single incident which released 238 tonnes. Without this incident, there would have been a slight increase of 4 tonnes year on year.

The average annual reported accidental oil release size has varied since 2011, from a low of 0.05 tonnes to a high of 2.1 tonnes. The average mass of oil released per occurrence increased, from 0.1 tonnes in 2019 to 1.3 tonnes in 2020. Infrequent but large releases form a big part of these annual totals, which was the case also in 2020. Since 2020, oil releases of more than 50 tonnes have made up less than 0.22% of the total number of releases, but over 75% of the total mass released. Three releases totalled more than 923 tonnes of oil.

5. Accidental Releases continued

The overall number of releases was relatively stable over the period, averaging around 270/year, with a range between 200 and 315, but the mass of releases varies much more widely. 2020's total number of releases is the lowest for the ten-year period covered (see *Figure 16*).

Figure 16: Oil Release Mass and Number



Source: OPRED, 2021

Releases by Oil Type

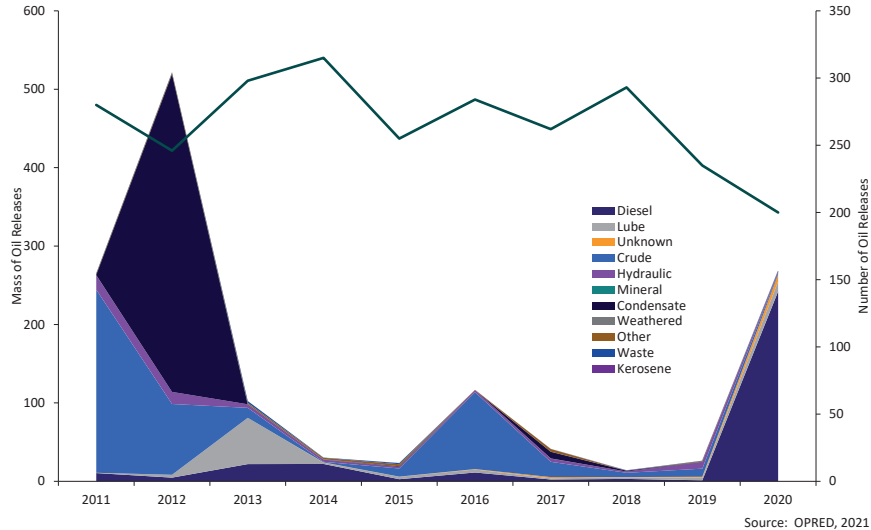
Determining the oil product type is an important element of an oil spill response: it enables understanding of how the release will behave in the marine environment under varying conditions and helps to determine the appropriate response strategy.

Diesel and light oils will be rapidly broken up by wind and wave action if released and then evaporate. Heavier hydrocarbon releases will be monitored and appropriate clean-up operations will take place, as determined in the installation's OPEP. This may include allowing the oil to break up in open water, to be digested by naturally occurring oil-degrading bacteria; mechanical recovery of oil at sea; and the use of dispersants to help break-up of the oil. If none is possible the operator may actively protect sensitive areas of shoreline and also collect and recover any oil that does come ashore.

Diesel was the most common hydrocarbon type released in 2020, with 242 tonnes accounting for over 90% of the total (see *Figure 17*). There were 43 releases of crude, one of which amounted to over 238 tonnes. The next largest category was lubricating oil, of which 13 tonnes were released (5% of the total).

5. Accidental Releases continued

Figure 17: Accidental Oil Releases by Product Type



Using historical data on the source of releases, operators can decide where to target their efforts. However, the information included in the PON1 database on the circumstances leading to releases is very narrow in its scope. In addition individual high-mass releases distort the data, making it hard to determine trends. Finally, the masses reported released are the worst-case estimates for each incident and so the true amount released is likely to be less.

The following analysis includes direct causation information where this is attributable from the source data. Environmental incidents usually result from a combination of factors coinciding, none of which is solely responsible. The analysis first identified whether the direct cause of releases was a result of a breach in the integrity of the asset or of the operational integrity. The totals for all oil releases are shown in Figure 18. Asset integrity breaches are the direct cause associated with most of the oil released across the period.

5. Accidental Releases continued

Figure 18: Breakdown by Direct Cause (including outliers)

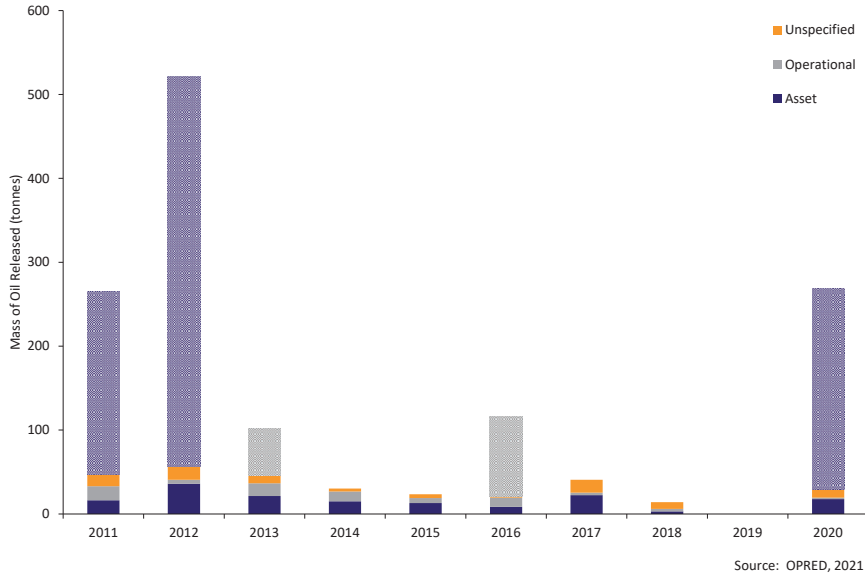
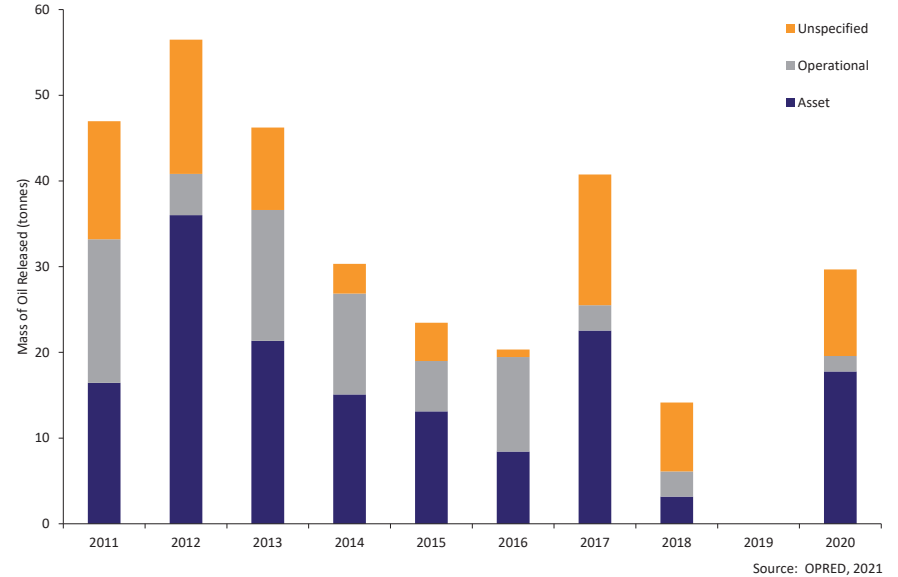


Figure 19 below excludes the outliers for clarity. Asset integrity-related releases are in the majority for all but one year in the period.

Figure 19: Breakdown by Direct Cause (excluding outliers)



5. Accidental Releases *continued*

The following tables provide a breakdown of the oil releases over the period by the top ten systems and equipment categories. Five categories appear in the top ten by both mass and frequency of release over the period: storage systems, pipework, hydraulic systems, bulk transfer systems and subsea tooling.

Table 1: Top Ten Systems by Number of Releases

System / Equipment	Number of Releases
ROV	24
Bulk transfer	18
Tanks/storage	18
Pipework	15
Hydraulics	9
Cranes	8
Drains	7
Pumps	6
Subsea tool	6
Wells	6

Table 2: Top Ten Systems by Mass of Releases

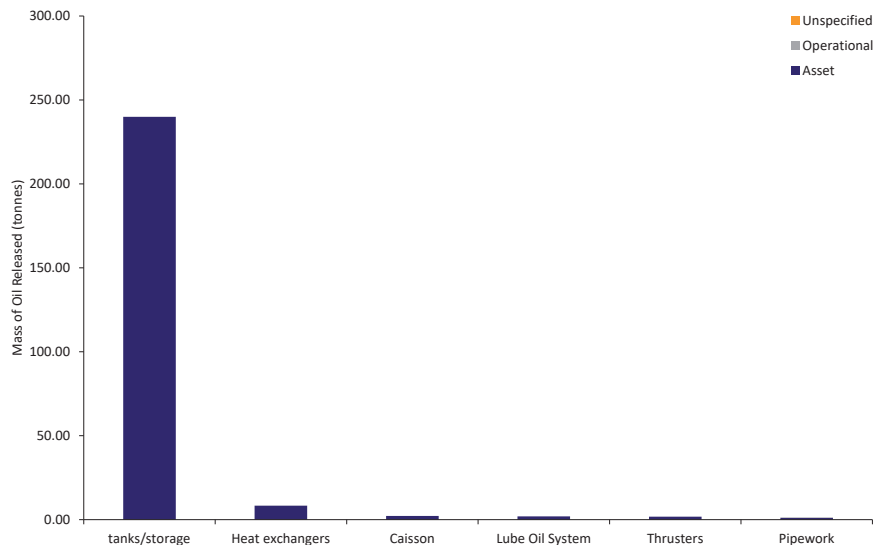
System / Equipment	Mass of Oil
Tanks/storage	239.95
Heat exchangers	8.33
Caisson	2.22
Lubricating oil system	1.92
Thrusters	1.78
Pipework	1.35
Wells	0.84
Hydraulics	0.37
Bulk transfer	0.31
Subsea tool	0.18

Figures 20 and 21 show releases from these systems with the attributed cause of release. Figure 20 includes the outlier oil release in the period.

5. Accidental Releases continued

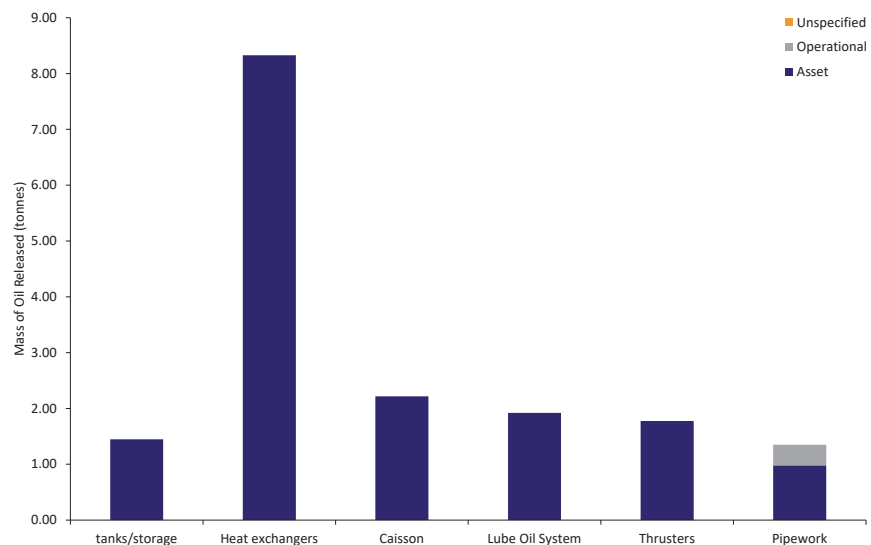
Once the outlier is excluded, it is easier to see that the predominant direct cause varies across the systems/equipment categories, with asset integrity being the causal factor in the majority of releases for all categories, while operational integrity issues accounted for 27% of the releases across all categories.

Figure 20: Direct Cause by System/Equipment Type (including outliers)



Source: OPRED, 2021

Figure 21: Direct Cause by System/Equipment Type (excluding outliers)



Source: OPRED, 2021

5. Accidental Releases continued

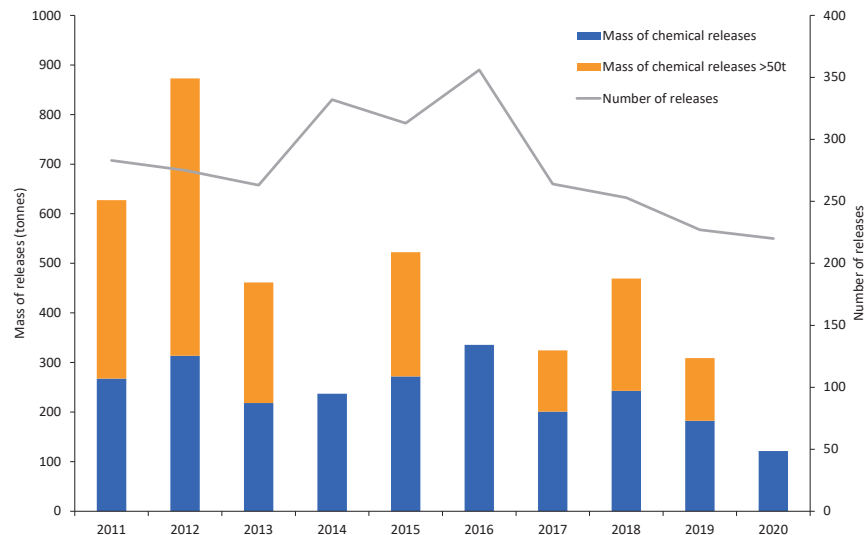
5.3 Accidental Chemical Releases

In 2020, 120 tonnes of chemicals were accidentally released in 220 incidents on the UKCS (see Figure 22). As noted earlier, 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 (H₂O) used as a solvent.

To put this into context, about 302,108 tonnes of chemicals were used on the UKCS in 2020, 101,142 tonnes of which were discharged under permit. Accidental releases therefore represent 0.04% of the total mass of chemicals used, and 0.12% of the chemicals intentionally discharged to sea under permit. The average reported chemical release size was 0.6 tonnes in 2020 - the lowest average since 2011 and just over a third of the annual average for the 2011-20 period (1.6 tonnes/year).

The total amount of chemicals accidentally released in 2020 has decreased by 61% since 2019.

Figure 22: Chemical Releases



Source: OPRED, 2021

5. Accidental Releases continued

The chemical PON1 data have been assigned hazard categories to show with greater clarity the potential impact on the marine environment. The CEFAS OCNS data⁶ were used to produce the classifications detailed below. More detail is given in Appendix 1⁷.

Table 3: Hazard Ranking Categories for the Breakdown of Accidental Chemical Releases

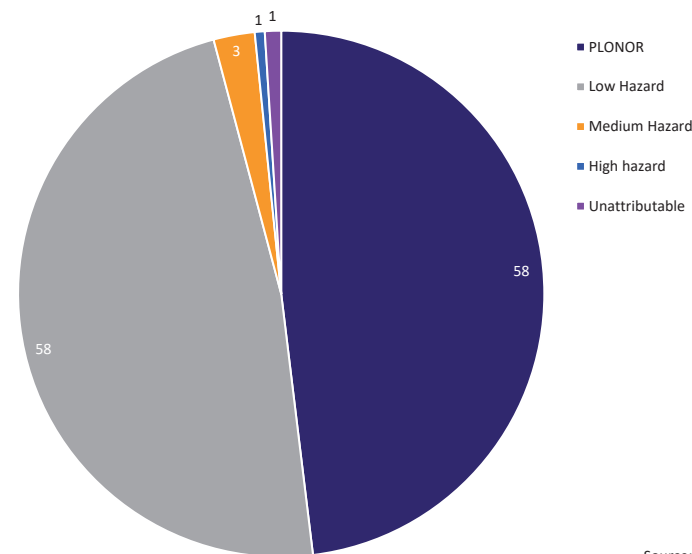
Hazard Ranking	Components
PLONOR	The PLONOR category comprises all those products for which PON1s were submitted that have been assigned PLONOR (Pose Little or No Risk) status.
Low	The low hazard category comprises OCNS groups D and E, gold and silver as the lowest ecotoxicity groupings. This excludes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

⁶ 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

⁷ Appendix found at www.oilandgasuk/environmentreport

Figure 23 shows that in 2020, 96% (116 tonnes) of all accidental chemical releases on the UKCS fell into the low and PLONOR hazard categories. 0.75 tonnes of the mass released fell into the high hazard category, or 0.6% of the total.

Figure 23: Total Mass of Chemical Releases by Hazard Category



Source: OPRED, 2021

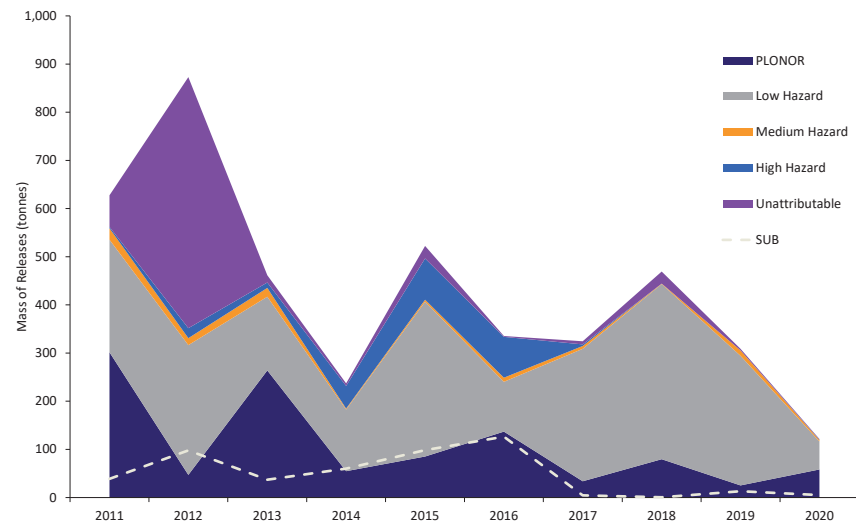
5. Accidental Releases continued

Figure 24 expands this to show releases across the 2011-20 period by hazard category. During this time, 4,281 tonnes of chemicals were reported in PON1 on the UKCS, representing a total of 2,786 incidents. PLONOR and low hazard category chemicals make up the majority (3,261 tonnes, 76%) of the mass released. High and medium hazard category chemicals contributed 6% (256 tonnes) and 2% (93 tonnes) by mass, respectively. The remainder (671 tonnes, 16%) fall into the unattributable category.

There has been an 81% (just over 505 tonnes) decrease in the mass of chemicals accidentally released between 2011 and 2020.

2020 was the lowest year since 2011 in terms of the mass of chemicals accidentally released. The total number of incidents also decreased to 220, again the lowest since 2011. Accordingly, the average reported release size has fallen during the period, from 2.2 tonnes in 2011 to 0.6 tonnes in 2020.

Figure 24: Mass of Accidental Chemical Releases by Hazard Category



Source: OPRED, 2021

5. Accidental Releases *continued*

Tables 4 and 5 provide a more detailed breakdown of 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.

Table 4: Top Ten Systems by Number of Chemical Releases

System / Equipment	Number of Releases
Pipework	22
Wells	18
Caisson	17
Hydraulics	16
BOP	15
Heat exchangers	11
Subsea manifold	11
Water injection	11
Cooling medium	10
Pumps	10

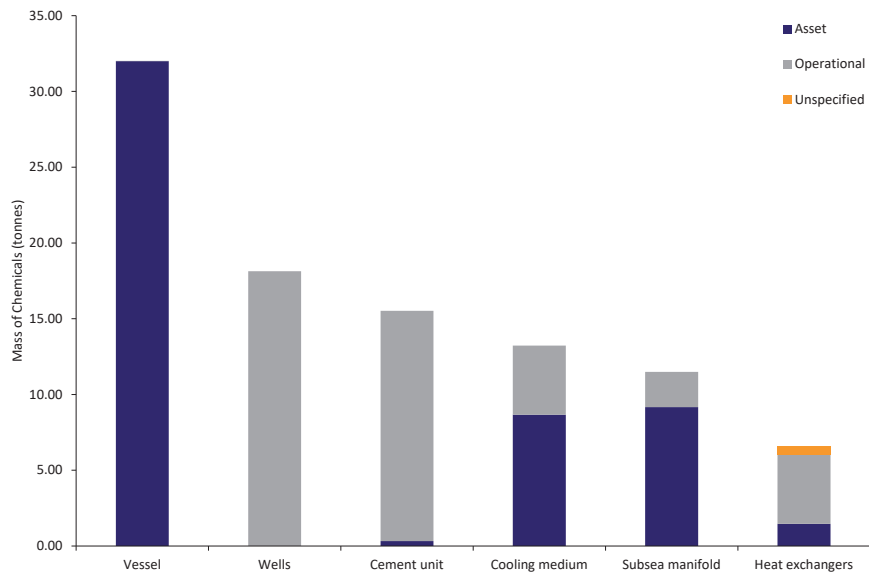
Table 5: Top Ten Systems by Mass of Chemical Releases

System / Equipment	Mass of Releases
Vessel	32.015
Wells	18.135
Cement unit	15.526
Cooling medium	13.228
Subsea manifold	11.488
Heat exchangers	6.604
Bulk transfer	5.051
BOP	2.665
Pipelines, umbilicals and flowlines	2.391
Bulk transfer	5.051

Figure 25 shows the direct cause category for each system. For cement unit systems, the primary cause of releases is operational breaches, as it is for wells and heat exchangers. For the other categories, asset integrity is more influential.

5. Accidental Releases continued

Figure 25: Chemical Releases by System/Equipment Category



6. Significant Issues and Activities

OGUK’s HSE Team manages the regulatory pressures emerging from governments in the UK 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.

Throughout the pandemic, OGUK supported the development of policies and protocols to maintain environmental standards and support a safe working environment for offshore staff, while reducing the spread of COVID-19.

The OGUK team also works with member companies 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 project deliverables. This section outlines our key areas of focus in 2020 and 2021.

Oil Spill Response

It is imperative the industry is prepared to deal with an incident immediately should it happen to ensure the least damaging impact on the environment. Accordingly, 2020 was a very busy year for our Oil Spill Response Technical Group, which established three sub-groups to review the oil spill response training for fishermen; a Shoreline Response Plan that covers the entire Scottish coastline; and the creation of a volunteer database to assist industry in case of a long-term incident. These sub-groups have continued throughout 2021.

6. Significant Issues and Activities continued

Chemicals

The close of 2020 saw the Brexit transition period come to an end. Throughout the year OGUK liaised with UK government (as well as the EU via the International Oil and Gas Producers Association (IOGP)) to ensure the UK industry's views were heard in consultations which may influence the environmental management practices of the UKCS.

Alongside OGUK's Supply Chain Team, a Brexit Contingency Council was formed, in which OGUK HSE staff worked with members in the REACH Sub-Group whose aim was to ensure a smooth transition from the European Regulation on Registration, Evaluation, Authorisation and Restriction of Chemicals (EU REACH) to UK REACH for our members. This group worked closely with the Department for Environment, Food & Rural Affairs, hosting interactive webinars and maintaining constant contact to resolve any issues that were predicted to arise.

OPRED has advised that a second five-year cycle of Risk-Based Approach (RBA) sampling and modelling of produced water will be initiated in 2021. The regulator presented a summary of the guidance to the Chemicals Technical Group and industry gave a detailed response to the proposals. OGUK is working with members to develop their operational environmental risk management process for produced water.

Radiological Issues

OGUK's Radiological Issues Technical Group has facilitated communication between members and the regulator for radiological substances, the Scottish Environmental Protection Agency (SEPA), on extending to offshore operations the scope of the Environmental Authorisations (Scotland) Regulations. Authorisations will transfer from RSA to EA(S)R as a result. A review of regulatory scope offshore was completed at the end of 2020 but the plan to consult with the industry was delayed by the cyber-attack on SEPA's data systems.

Atmospherics

The Atmospherics Technical Group focussed on several work areas throughout 2020, including a project to facilitate an efficient and environmentally beneficial approach for large combustion plant (LCP) monitoring requirements offshore. The aim is to establish an industry standard for emissions testing that will remove the need for third-party specialists and bulky testing equipment by allowing stack monitoring to be conducted at will. This approach has regulatory approval from OPRED thanks to the efforts of the Atmospherics Technical Group. OGUK is accordingly developing training material so it may be put into practice.

The group have also been looking at green fuel alternatives for engines and working with OPRED to ensure compliance with updated guidelines.

6. Significant Issues and Activities continued

Guidelines

Throughout 2020, 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.

Consultations & Regulator Engagement

OGUK continues to co-ordinate industry responses to consultations, with notable examples from 2020 including proposed amendments to the Environmental Impact Assessment regime for offshore oil and gas projects; the Offshore Chemical Regulations and Oil Pollution Prevention and Control Regulations; and MMO Training Standards.

7. Glossary

Anaerobic digesters	Micro-organisms that break down biodegradable material in the absence of oxygen
BEIS	Department for Business, Energy and Industrial Strategy
Bunding	A retaining wall for safety or environmental purposes
Bq	Becquerel
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CH₄	Methane
CO	Carbon monoxide
CO₂	Carbon dioxide
Discharge	A permitted disposal of substances offshore
EEMS	Environmental Emissions Monitoring System
EOR	Enhanced Oil Recovery
Flaring	The controlled burning of natural gas in the course of oil and gas production operations
GHG	Greenhouse gases
HMCS	Harmonised Mandatory Control Scheme

7. Glossary continued

HSE	Health and Safety Executive
IOGP	International Association of Oil & Gas Producers
LCP	Large Combustion Plant
mm boe	Million barrels of oil equivalent
MWth	Megawatt thermal
N2O	Nitrous oxide
NORM	Naturally occurring radioactive materials
NOx	Nitrogen oxides
OCNS	Offshore Chemical Notification Scheme
OGA	Oil and Gas Authority
OPEP	Oil Pollution Emergency Plan
OSPAR	The Oslo/Paris Convention for the protection of the marine environment of the North East Atlantic
PLONOR	Pose Little or no Risk – used by OSPAR to classify substances used and discharged offshore

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.
Production efficiency	The total annual production divided by the maximum production potential of all fields on the UKCS
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
Release	An unintentional discharge of oil or chemicals
SUB	SUB chemicals are those classified under OCNS as harmful and should be phased out and substituted with a less harmful substance.
UKCS	UK Continental Shelf

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