HS&E REPORT
2022

OFFSHORE ENERGIES UK

Health, safety and environmental reporting
for the UK's offshore energy industry

OFFSHORE ENERGIES UK

An integrating offshore energy industry which safely provides cleaner fuel, power and products for everyone in the UK.

Working together, we are a driving force of the UK's energy security and net zero ambitions. Our innovative companies, people and communities add value to the UK economy.

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HS&E REPORT 2022

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Foreword

Mark Wilson, Director
HSE & Operations
Offshore Energies UK

Welcome to OEUK's 2022 *Health, Safety & Environment Report,* which provides an overview of the offshore energy industry's health, safety and environment performance in 2021. Delivering safe and environmentally sound operations is the goal of all our member organisations and drives the work our members put in to OEUK groups and initiatives.

By working with our members, as well as our regulators, we can continue to develop and introduce improvements across all areas of HSE: safe isolations, maintenance, human performance and the many others. Better technology and approaches to data are two other important tools that will be critical to the success of our ongoing effort to keep improving HSE performance. In fact, one area where we perform well but could still improve is the way in which the industry shares its data.

Doing so can help us anticipate problems better and minimise them. By looking out for weak signals, we can prevent underlying causes worsening and incidents occurring, whether hydrocarbon releases, serious injuries or environmental impacts. Constant vigilance about anything that could threaten safe and sustainable operations is absolutely key.

During what was a challenging period for this sector, we did not lose sight of our responsibilities for good HSE management and compliance and that has been demonstrated by the performance captured in this report.

As we have reported in previous years, the most common cause of personal injuries was in relation to slips, trips and falls. It was the fifth consecutive year without a fatality. The longer-term reportable non-fatal injury rate saw a slight increase. However the absolute number and the rate of injuries in 2021 are lower than in most years of the last two decades. Similarly steady performance was seen across UKCS helicopter operations, where 2021 was free of accidents and serious incidents. Flying hours increased by 52% to over 63,000 in 2021, up from the low of 42,000 in 2020. This performance reflects the amount of work being undertaken in the areas of operational effectiveness, reliability and the introduction of new technology and equipment.

Priority areas of focus across the environmental area included oil spill response and improved emissions monitoring. This was conducted via continued engagement across industry and the regulator while ensuring that the impact on operations was minimal. Analysis of the 2021 data shows industry delivering improved environmental performance across many areas. For instance, 2021 saw the lowest mass of chemicals accidentally released since 2011, with an overall decrease of 40% of chemicals of all kinds discharged to sea. Produced water discharge volume continued to fall and oil discharge fell 10%. Emissions from the production of oil and gas were down 20% in 2021, and the generation of waste was reduced by 28%.

Ongoing industry action to prevent hydrocarbon releases, aligned to the adoption of the Principles of Process Safety Leadership, saw the lowest amount of reportable releases since 2016, although there was one confirmed major hydrocarbon release in 2021. This is clearly one too many and the overall performance, though improved, seems

to have stalled. More has been done to look at how we can reduce and prevent hydrocarbon releases, including OEUK guidance that outlined good practice across a wide range of assurance activities. If you have not seen it, I encourage you to do so (https://oeuk.org.uk/product/assurance-toolkit/).

One area industry is focused on is the maintenance backlog. This began to rise in 2018 but had remained below the peak seen in earlier years until 2020. The disruption to normal operations and the associated down-manning that the pandemic made necessary clearly affected the total maintenance backlog levels in 2020 and 2021.

To help address this OEUK established an industry Maintenance Reduction Task Finish Group. The outcome was an agreed set of key performance indicators (KPI), and a reporting mechanism that was created to support the objective of reducing the backlog. I encourage you to be actively engaged, with your own understanding of maintenance backlog for those areas you support, and challenge the green as well as the red.

The industry will continue to reduce emissions as part of the North Sea Transition Deal, which will accelerate the energy transition towards new technologies, cutting emissions even as the sector continues to supply oil and gas. New areas of activity will grow the supply chain, stimulating jobs and opportunities for communities across the UK.

Across the piece, we're in action already, supporting the development of new 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. We're also focused on extending our expertise as an industry into new types of offshore energy production, bringing the experience of intense cross-industry collaboration and co-operation dedicated to improving HSE performance to the energy transition.

Industry's *Principles of Process Safety Leadership*, rolled out in 2019, were an important step forward, and a great example of industry collaboration in action. We're pleased to be leading a renewed focus on these, in particular on operational integrity, knowing that delivering this means delivering further improvements in safety and environmental performance. We have so much to share with colleagues across the energy spectrum in terms of lessons learned, best practices and technical guidance, much of which is certainly transferable.

We hope you find the content of this report to be both interesting and informative.

Thank you very much to our members for your valued contribution.

Any queries should be directed to OEUK HSE & Operations Director, Mark Wilson, at mwilson@oeuk.org.uk

Key findings

Environment

Unintentional releases

Lowest mass of chemicals accidentally released since 2011. The total number of incidents also decreased to **211**, again the lowest since 2011. Accordingly, the average reported release size has fallen during the period, from **2.2 tonnes** in 2011 to **0.5 tonnes** in 2021

Largest single oil release was **2.58 tonnes**, while the largest chemical release was **64 tonnes**

0.5 tn

Produced water

The mass of discharged oil decreased by **10%** from **2,324 tonne** to **2,028 tonnes**, making up **0.001%** of the total mass of produced water, in line with the previous six years

The average concentration of oil in produced water discharged was **17.3 mg/l**, down from **17.8 mg/l** in 2020, the first decrease since 2016

Discharges – chemicals

A **9%** decrease from 2020 in sub chemicals discharged

Overall decrease of **40%** of all chemicals discharged to sea

10%

Other discharges – NORM and Drill cuttings

There was a **33%** decrease in discharged cuttings to **23,769 tonnes**, from **35,784 tonnes** in 2020

There was a **4%** decrease in the total NORM activity (Pb-210, Ra-228, Ra-226) discharged to sea compared with 2020

33%

Waste

Total waste decreased year on year to **128,840 tonnes** in 2021 from **180,995** in 2020 which is the second lowest figure since 2017

The lowest amount of waste sent to landfill to date at **24,134 tonnes**

128,840 tn

Atmospherics

Emissions from the production of oil and gas were down **20%**, methane emissions were down **36%** from base year (2018) and flaring and venting were down **36%**

On track to meet NSTD 2027 target

Safety

Process

There was one confirmed major hydrocarbon release (HCR). However, 2021 saw the lowest amount of HCR reported under the Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 2013 (RIDDOR) since 2016

Average safety critical maintenance backlog increased by **50%** compared with 2020 due to the impact of the pandemic

50%

Personal

For the 5th year running there have been no work-related fatalities

The over-seven-day injury rate increased compared to 2020, up to **225** from **217** injuries per **100,000 workers**. The specified injury rate increased, from **52** to **69** per **100,000 workers**. Both the absolute number and the rate of injuries in 2021 are lower than in most years of the last two decades

Aviation

Offshore helicopter operations were accident-free

Flying hours increased by **52%** to over **63,000** in 2021, up from the low of **42,000** in 2020

52%

Health

Medevac

In 2021, emergency medevacs were requested a total of **261** times

In line with previous years, the most common reason for an emergency medevac was for a suspected cardiac incident, closely followed by injury and acute abdominal issues

Medicals

111,612 OEUK medicals were performed by registered doctors, slightly down from **111,647** in 2020

Blood pressure remained the most common cause for failing an offshore medical, accounting for **15%** of the total

3. Environment

3.1 Permitted offshore emissions and discharges

The oil and gas industry on the UK Continental Shelf (UKCS) is always doing its best to improve its environmental performance and efficiency as demonstrated by the findings of successive OEUK reports. 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. At the same time, as the basin matures, production becomes more of a challenge, technically.

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 that are monitored include: produced water; chemicals; drill cuttings; greenhouse gas emissions; natural that is gas flared and vented; and waste generated by upstream oil and gas operations.

Produced water

When oil and gas are produced, water within the hydrocarbon reservoir is also brought to the surface. This produced water can be more than 95% of liquids produced from some fields. It is separated from the hydrocarbons before either being re-injected into the reservoir to maintain production; or it is 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 mostly declined since 2000 (*see Figure 1*). 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.

Only 120mn m^3 of produced water were discharged to sea in 2021, down from 129mn m^3 the year before. The amount of produced water re-injected to the subsurface rose slightly, from 75mn m^3 in 2020, to 76mn m^3 in 2021.

The composition of the produced water

Produced water contains small amounts of substances from the reservoir rock. These include dispersed oil, dissolved organic compounds, naturally occurring radioactive matter (NORM) as well as chemicals injected to increase production. The composition of produced water is determined by the reservoir geology, maturity and stage of production life.

Figure 1:
Total produced water discharged to sea and re-injected versus production

Source: EEMS, May 2022; NSTA

Dispersed oil in produced water

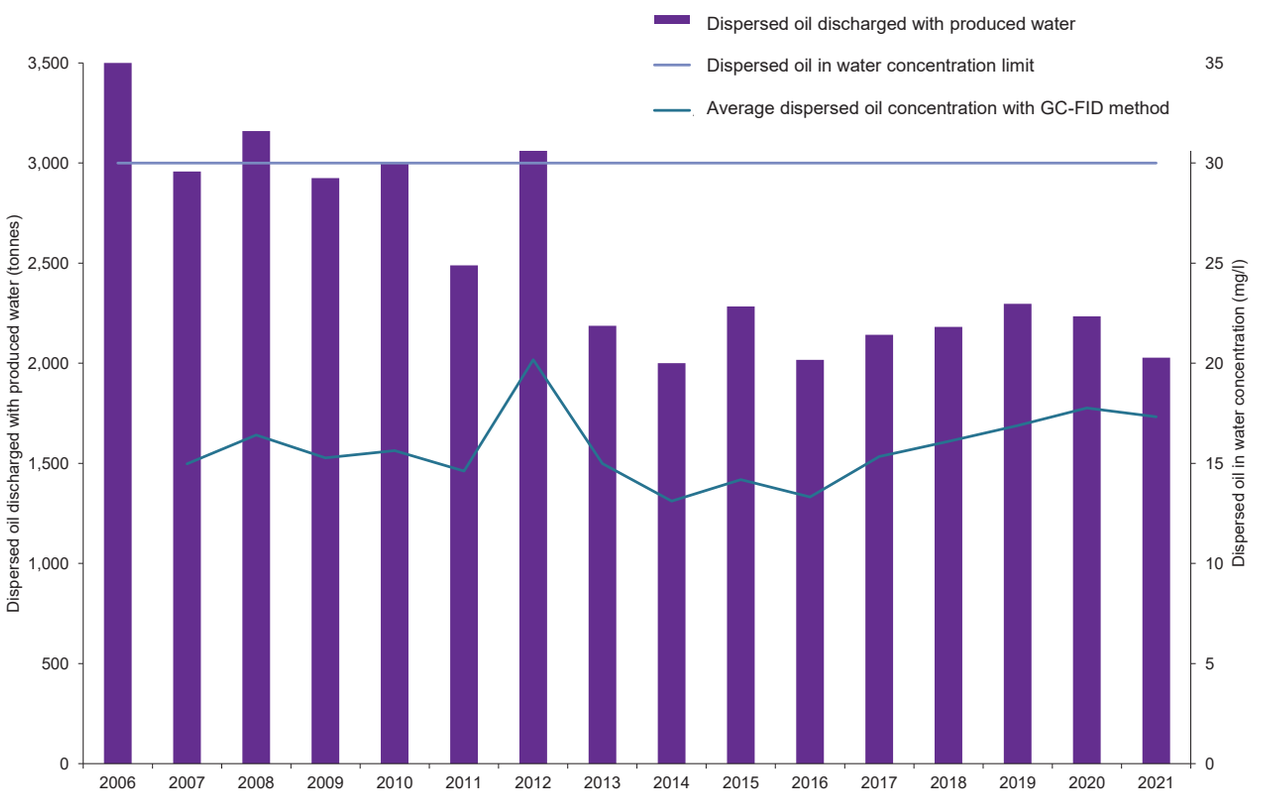
As shown in Figure 2 around 2,028 tonnes of dispersed oil were discharged to sea with produced water in 2021, making up 0.001% of the total mass of produced water. This is in line with the previous six years. The total mass of oil discharged dropped 10% from 2020.

OSPAR Recommendation 2001/1 limits individual installations to an average dispersed oil-in-water concentration of 30 milligrammes/litre (mg/l). In 2021, the average concentration across industry was 17.3 mg/l, down from 17.8 mg/l in 2020. This was the first decrease since 2016. At such low concentrations, it is quickly broken down by naturally occurring bacteria.

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. These oblige the operator to notify

Figure 2:
Oil discharged with produced water to sea



Source: EEMS, May 2022

the relevant environment agency if the concentration of Ra-226 is greater than 0.1 Becquerels(Bq)/ml.

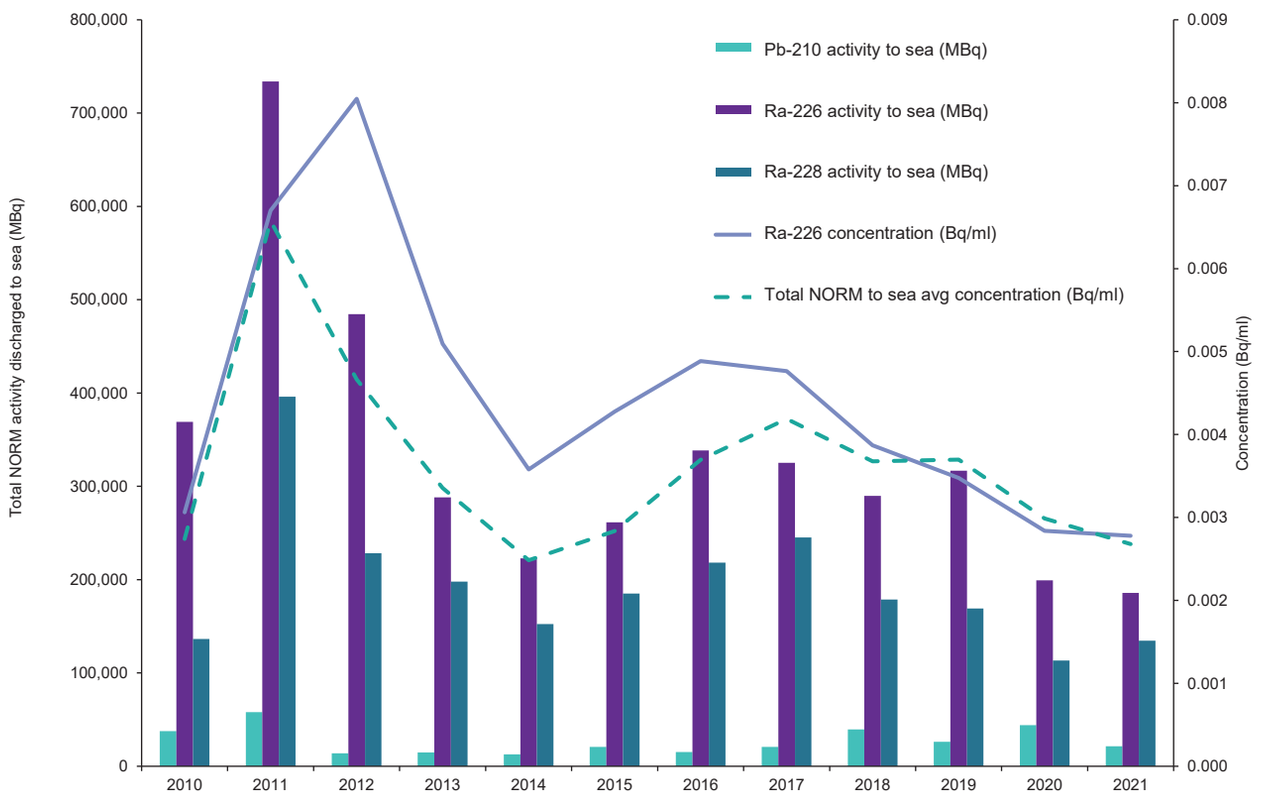
Figure 3 shows the activity and concentration of NORM discharged to sea by isotope. There was a 4% decrease in the total NORM activity (Pb-210, Ra-228, Ra-226) discharged to sea compared with 2020. How much NORM is discharged depends on the reservoir conditions and the volume of produced water discharged. The average Ra-226 concentration and the average total NORM concentration remain consistently and significantly below the 0.1 Bq/ml limit.

Chemicals

The offshore oil and gas industry uses chemicals to look for and produce hydrocarbons. But it may only use as much as is needed for these operations, in order to avoid waste and ensure responsible environmental performance. OPRED must permit all discharges before they take place and operators must constantly review the volume and the types of chemicals they use.

Chemicals that may be used and discharged have first to be registered with the Centre for Environment, Fisheries and Aquaculture Science's (CEFAS) Offshore Chemical

Figure 3:
NORM discharged in produced water



Source: EEMS May 2022

Notification Scheme (OCNS). 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' (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. The UK approach to reporting chemical discharges is based on a "worst-case" scenario rather than actual quantities released.

Mass of chemicals discharged

In 2021, just under 60,900 tonnes of chemicals were discharged to sea (145 tonnes/mn boe produced). Of that total, 49% (30,100 tonnes) came from drilling activities; 50% (30,500 tonnes) from production-related activity; and the rest (280 tonnes) was pipeline chemicals.

Most of the mass of chemicals discharged are used in drilling fluids and cement, which are important for safety and well control. The amount of drilling chemicals discharged has fallen by 53% in the past year, as there has been less drilling. The spike in 2013 (*see*

Figure 4:
Production, drilling and pipeline chemicals discharged

Source: EEMS May 2022; NSTA

Figure 4) is due to more complex wells that need more chemicals. The subsequent drop in drilling chemicals discharged in 2020 and 2021 mirrors the drop in drilling during the pandemic.

Although UKCS production has been in overall 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. Despite this, 2021 was the first year since 2013 when the permitted discharge of production chemicals fell, down by 5,100 tonnes on 2020.

Chemicals used for pipeline maintenance are designed to prevent corrosion or the build-up of scale. As shown in Figure 4, the amount discharged declined for the second consecutive year, to 300 tonnes, and accounted for under 0.5% of total chemicals discharged. As with drilling activity, pipeline works will fluctuate from year to year and chemical discharge will largely reflect this.

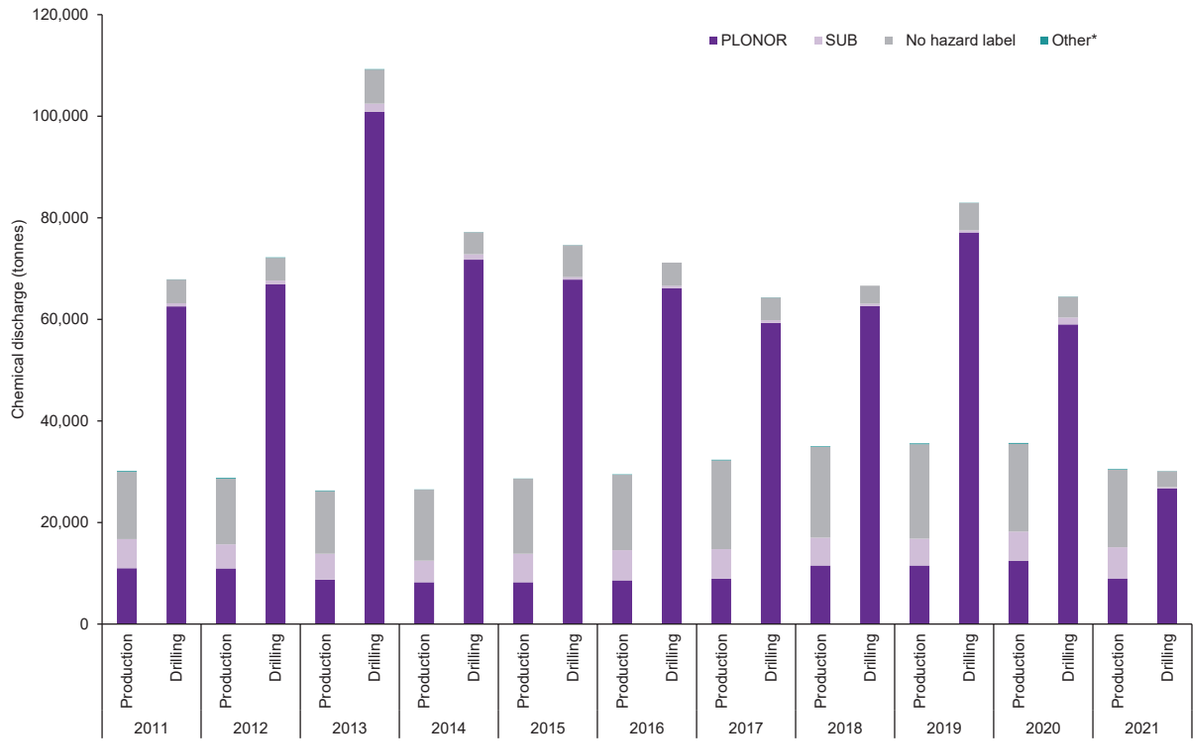
Composition of chemicals discharged

In 2021, 59% of chemicals discharged to sea from offshore oil and gas operations were PLONOR and 11% were SUB chemicals. Operators had been obliged to phase out, where practical, the use of all SUB chemicals by the end of 2017.[1] A review of the OSPAR Recommendation 2006/0.32 Chemicals that

[1] See http://www.ospar.org/documents?v=7336

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

Figure 5:
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 2022

are, or which 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.

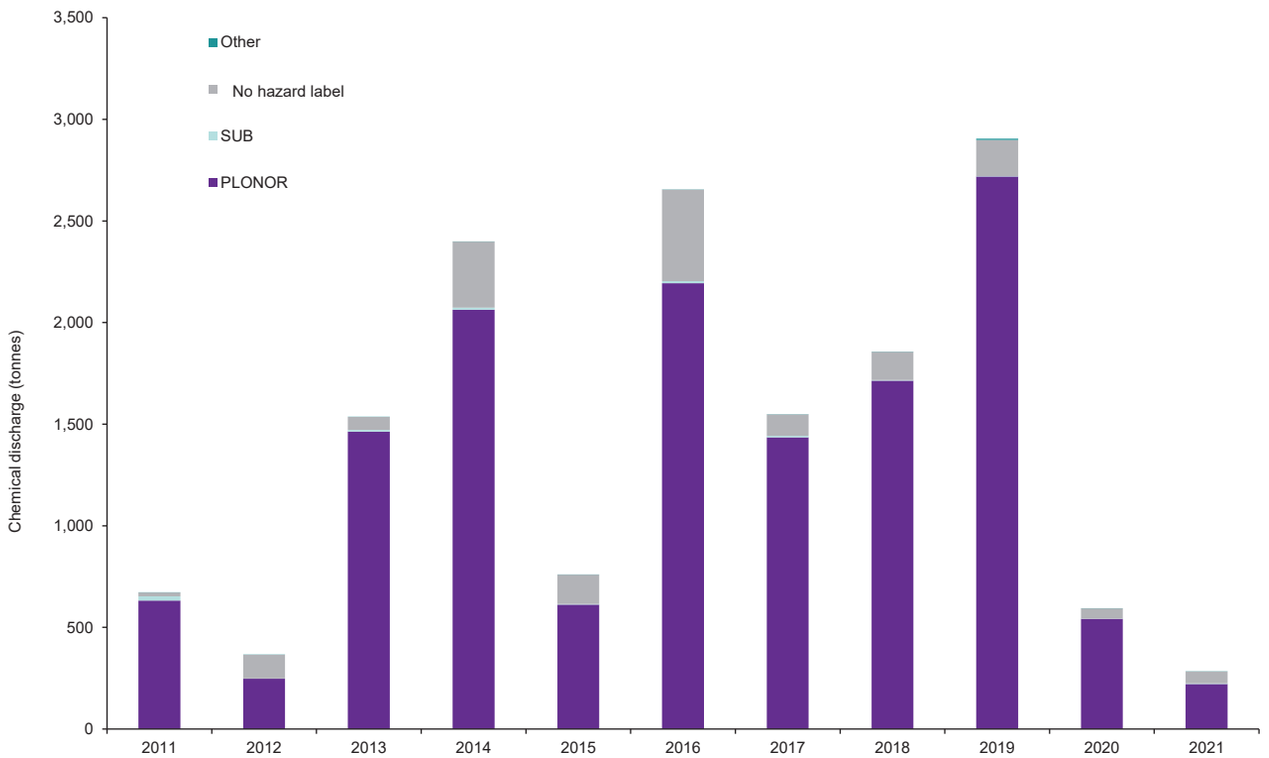
In 2020, the volume of SUB chemicals discharged to sea rose by 25% year-on-year to over 7,000 tonnes but in 2021 the downward trend was resumed with a decrease of 9% since the previous year. Overall, there was a decrease of 40% of all chemicals discharged to sea in 2021. This was one of the largest year-on-year changes seen.

Drill cuttings

Drill cuttings are fragments of rock broken off during well drilling. They are brought to the surface by, and mixed with, the 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 type of fluid that is 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.

Figure 6:
Breakdown pipeline chemicals discharged by classification



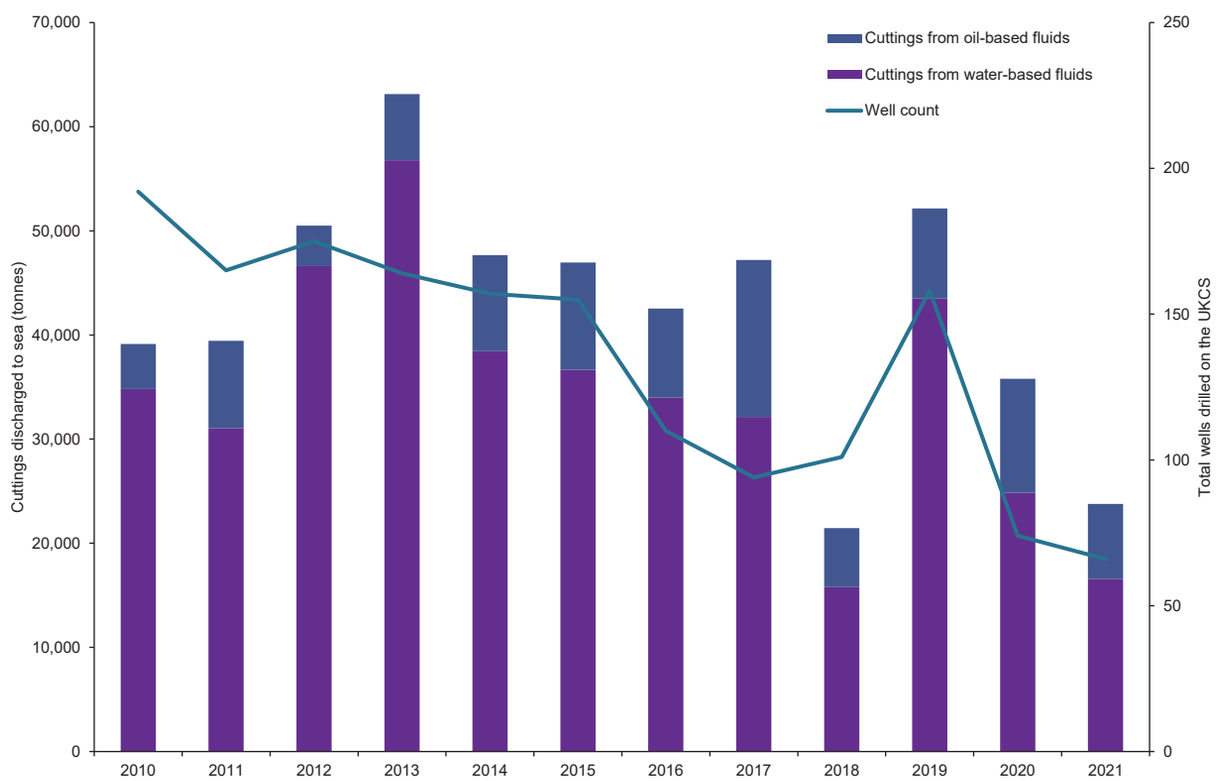
*Other includes those chemicals reported in EEMS that are not classified as PLONOR or SUB but contain hazardous materials listed under OSPAR Annex A

Source: EEMS May 2022

Whether these are 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 23,769 tonnes, 2021 continued the downward trend and saw less discharged than in previous years. With 185 km of wells drilled on the UKCS in 2021, this represents 128 tonnes/km drilled. The peak in 2013 (*shown in Figure 7*) was due to more complex wells being drilled.

Figure 7:
Drill cuttings discharged to sea



Source: EEMS, May 2022, OEUK

Of the 16,700 tonnes of cuttings coated with water-based fluids, fewer than 0.004% were returned to shore for treatment and disposal. The rest were either discharged to sea or injected as permitted.

Of the 27,800 tonnes of oil-based fluid cuttings, 66% (18,200 tonnes) were returned to shore for treatment, up 2 percentage points from 2020. Around 7,200 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.

3.2 Atmospheric emissions

Producing, treating and exporting hydrocarbons cause atmospheric emissions of various substances, including greenhouse gases (GHG) which drive climate change. The UK industry has committed to reduce such emissions as part of the North Sea Transition Deal, an agreement between the government and the upstream which will help the UK meet its net-zero emissions goals. Stepped targets mean industry must deliver a series of reductions in total GHG emissions against 2018 baselines: 10% by 2025; 25% by 2027; and 50% by 2030.

Activities that cause emissions include combustion to provide electricity to power compressors and pumps; the flaring of excess gas for safety reasons 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) and oxides of nitrogen (NOx) and sulphur (SOx). Small amounts of nitrous oxide (N_2O) are also emitted. Releases of volatile organic compounds (VOCs) and CH_4 may occur during tank loading or from firefighting equipment. Operators are focused on all these sources and have taken action to ensure that emissions are reduced. More information about these activities and the relevant performance data about atmospheric emissions of greenhouse gases can be found in OEUK's *Emissions Report 2022*.

Key findings from the report show emissions from the production of oil and gas were down by a fifth in 2021, methane emissions were down 36% from base year (2018) and flaring and venting were also down 36%. Forecasts also suggest the basin is going to meet the targets set in the Deal for 2025 and 2027, but that further action will be needed in order to reach 50% by 2030.

3.3 Waste

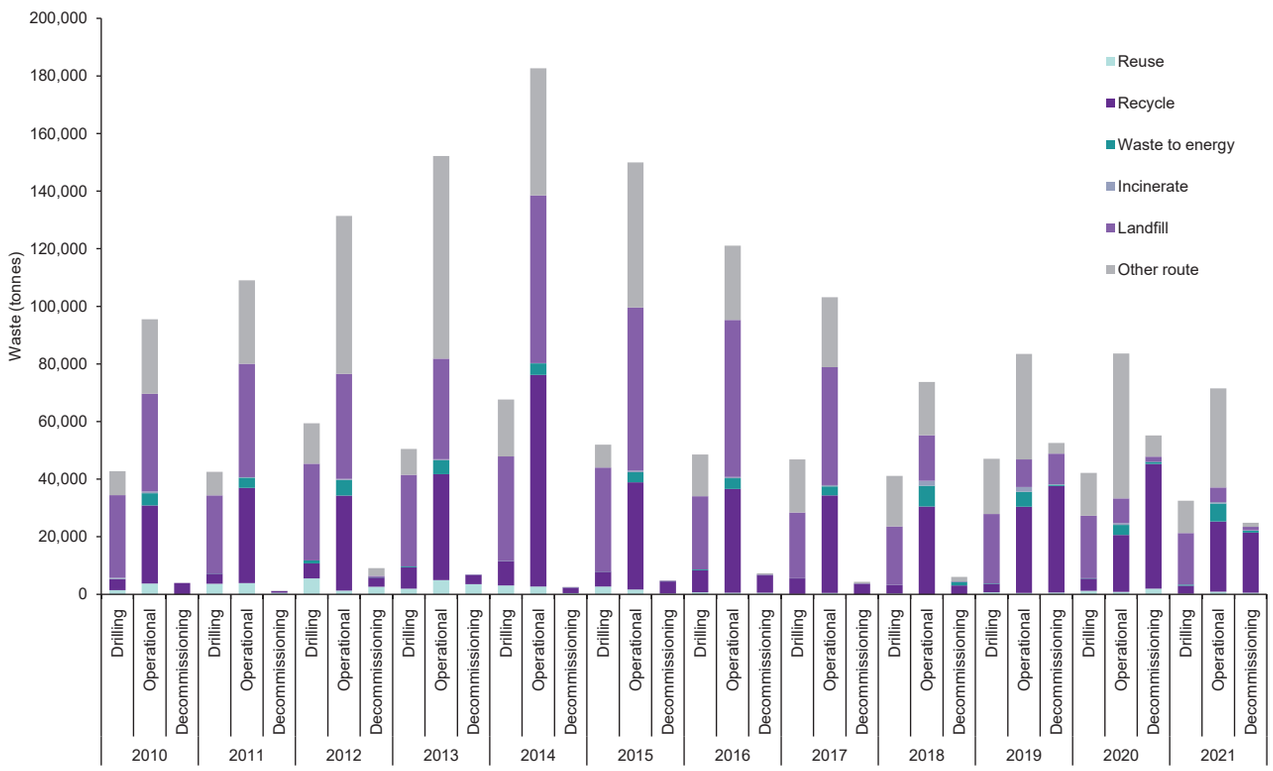
Like any other industry, oil and gas production generates waste that must be disposed of. Waste originates at various points in the life-cycle and can be solid or liquid, hazardous or non-hazardous. Waste that is classified as hazardous only presents a risk to the environment if it is incorrectly managed. 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 transport to shore for processing by a licensed waste contractor. As landfill is costly and unsustainable in the long term, operators sort waste in order to maximise reuse and recycling.

The total amount, as well as the form of waste generated, varies from year to year depending on how much exploration, production, maintenance and decommissioning work there has been.

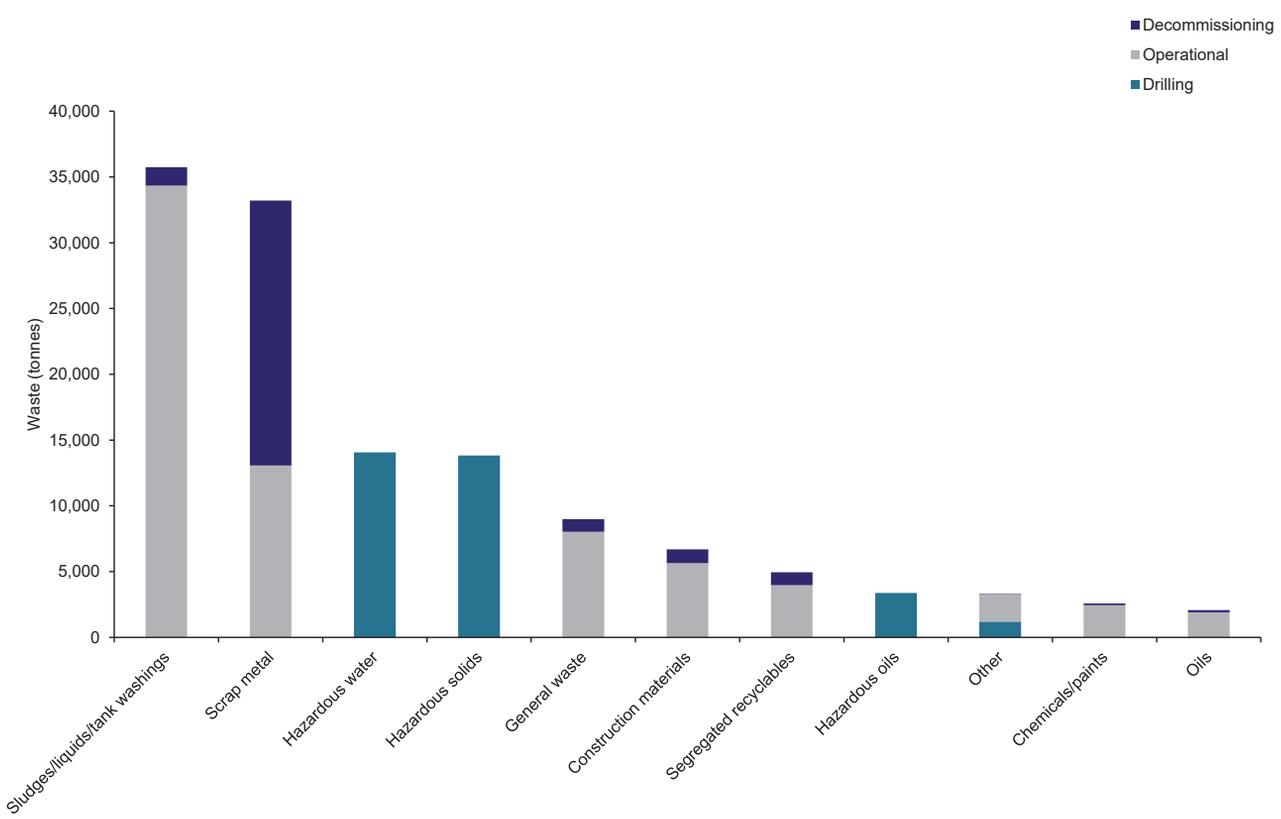
As shown in Figure 8, total waste fell year on year to 128,840 tonnes in 2021 from 180,995 in 2020. This was the second lowest figure since 2010.

Figure 8:
Waste generated by offshore activity



Source: EEMS, May 2022

Figure 9:
Operational, drilling and decommissioning waste types



Source: EEMS May 2022

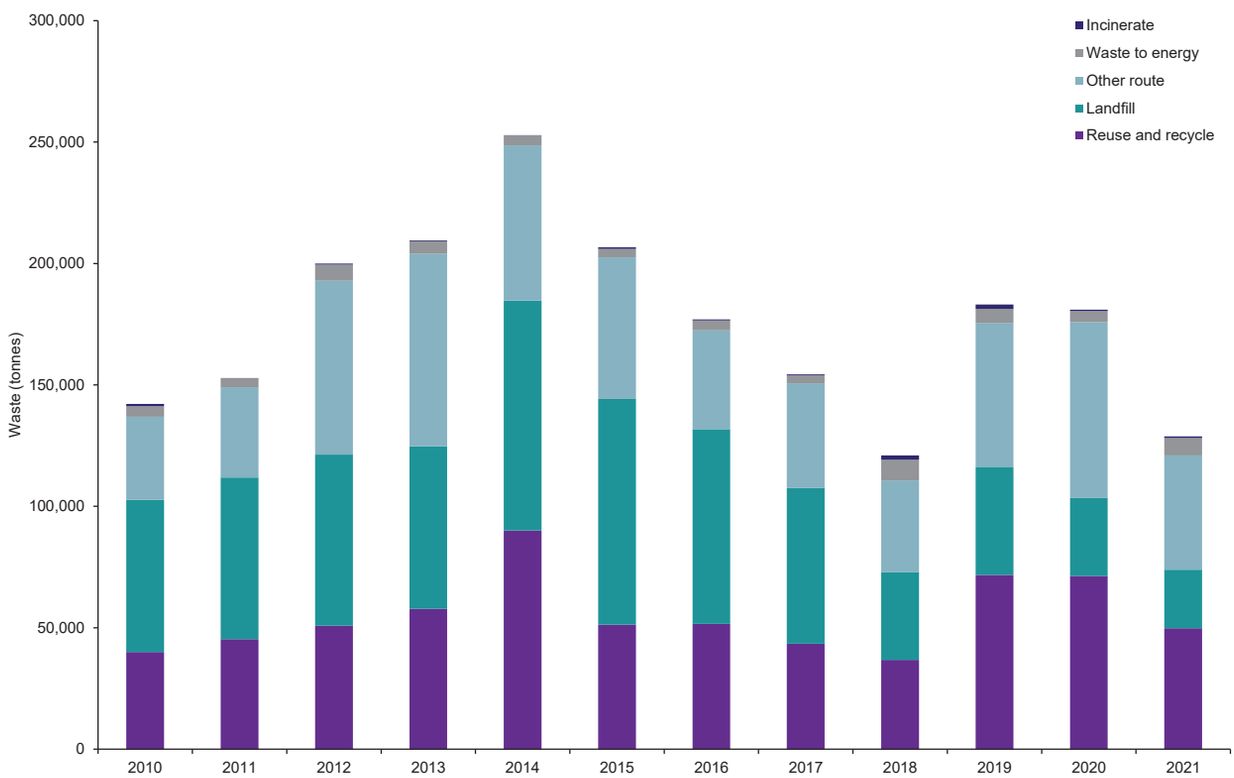
Waste composition and disposal

Waste is 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 remained the largest category of waste (28%) disposed of in 2021, with this including the backloading of drilling muds.

As shown in Figure 10, 2021 again saw less waste sent to landfill. This was the lowest amount to date (24,134 tonnes) and also a 62% reduction since 2010. However, there

Figure 10:
Total waste generated offshore (by disposal method)



Source: EEMS May 2022

was also a 30% reduction in waste being reused or recycled, with 49,796 tonnes in 2021 compared with 71,325 in 2020. Disposal routes categorised as "other" include the treatment of aqueous wastes, composting and land spreading. These routes fell slightly this year, with 47,000 tonnes (36% of waste) being disposed of in these ways in 2021 compared with 72,500 (40% of waste) in 2020.

The amount of decommissioning waste generated in 2021 more than halved (down by 55%) with 24,900 tonnes being produced compared to 55,200 in 2020. Of that, 89% was re-used, recycled or used for power generation.

3.4 Unintentional releases

The UK oil and gas industry minimises unintentional oil and chemical releases by managing the plant, process and people elements that could cause 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. OEUK members are encouraged to share experiences from incidents and any lessons that have been learnt in its forums and work groups.

Despite these efforts, some unintentional 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 and 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 the possibility of any large oil release reaching the shoreline, and where.

Overview from 2011-21

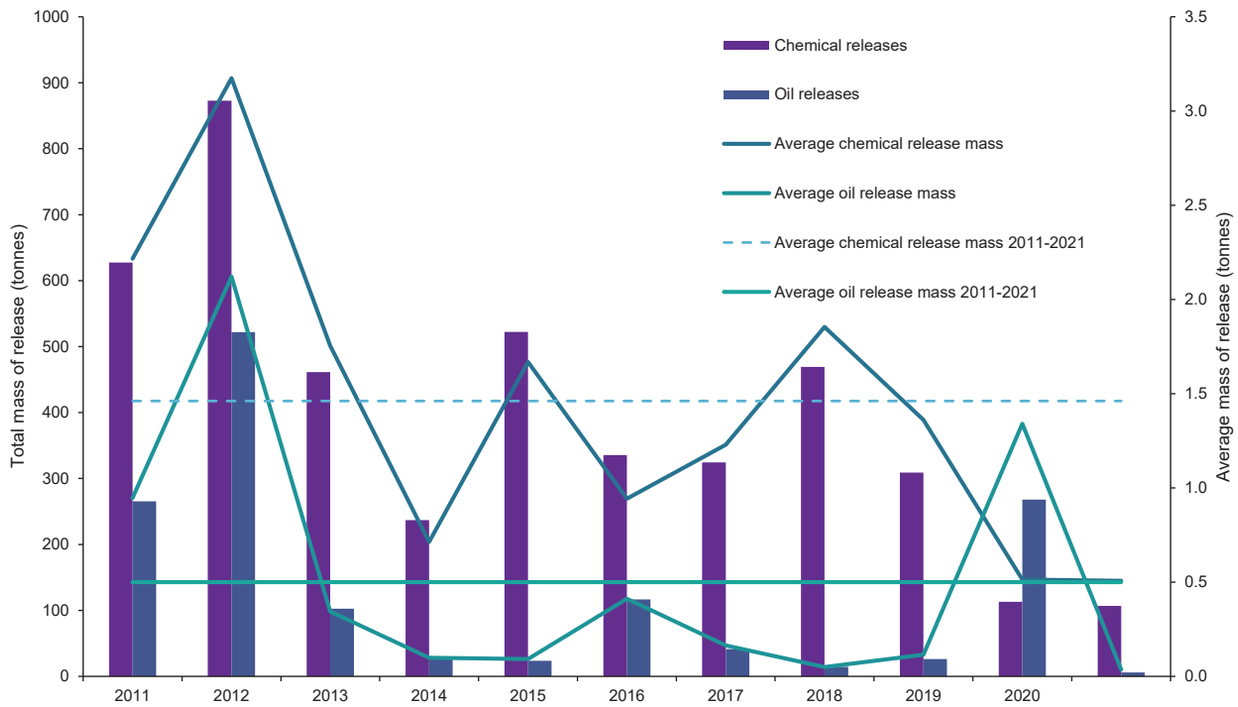
PON1 data are publicly available on the BEIS website and updated regularly.[3] The following analysis is based on the PON1 dataset from 2011-21. Further analysis has been carried out to categorise PON1 data from this period by product released; hazard category; and source of unintentional releases.[4]

As shown in Figure 11, the amount of chemicals and oil unintentionally released to the marine environment has varied over the last ten years. This reflects the sensitivity of this data to rare but high-mass events. The largest single oil release in 2021 was 2.58 tonnes, while the largest chemical release was 64 tonnes.

The total mass of chemicals and oil released in 2021 was down by a tenth on 2020 and it was the third consecutive year where releases have declined. The total amount of oil and chemicals unintentionally released in 2021 is less than the total permitted mass discharged to sea (*see following sections*).

[3] The BEIS PON1 data are available at https://itportal.beis.gov.uk/eng/fox/pon1/PON1_PUBLICATION_EXTERNAL/viewCurrent
[4] Please note data analysis does not include any releases that are currently under review by the regulator.

Figure 11:
Unintentional chemical and oil release mass



Source: OPRED, 2022

3.4.1 Unintentional oil releases

In 2021, there were 165 unintentional oil releases on the UKCS, involving 6 tonnes of oil released to the marine environment. To put this into context, in the same year, about 2.028 tonnes of oil were discharged to sea in produced water, under permit. This means that unintentional oil releases represented 0.3% of the total oil that entered the sea.

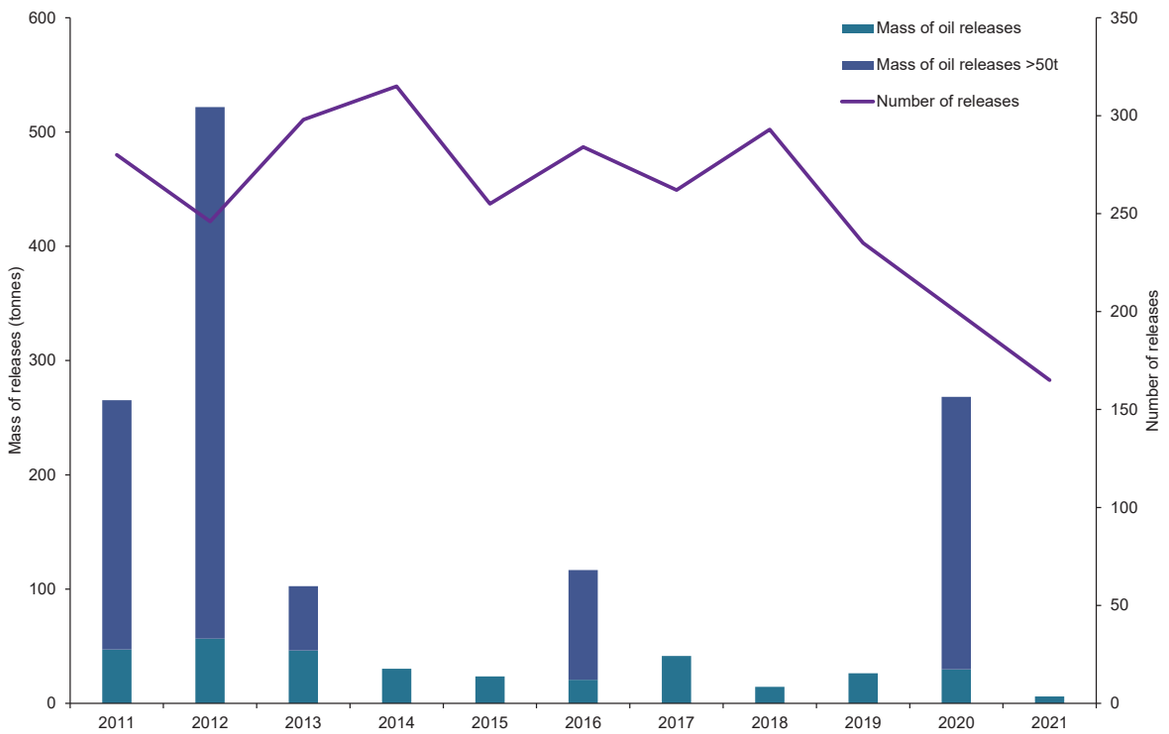
In 2020, there was a single, high mass oil release which resulted in a deviation from the emerging trend. The total mass of oil releases in 2021 are more in line with the previous year's figures, with 6 tonnes of oil being released in 2021 compared with 268 tonnes in 2020.

The average annual reported unintentional oil release size has varied since 2011, from a low of 0.05 tonnes in 2021 to a high of 2.1 tonnes in 2012. Infrequent but large releases form a big part of these annual totals, such as has been seen in 2020, as shown in Figure 12.

The overall number of releases has stayed relatively stable over the period, averaging around 250/year, with a range between 165 and 315, but as Figure 12 shows, the mass of releases varies much more widely. 2021's total number of releases is the lowest for the ten-year period covered.

NB: the 2021 data comes from the publicly available BEIS Integrated Reporting System (IRS) PON1 portal and exclude releases that are currently under review.

Figure 12:
Oil release mass and count



Source: OPRED, 2022

Releases by oil type

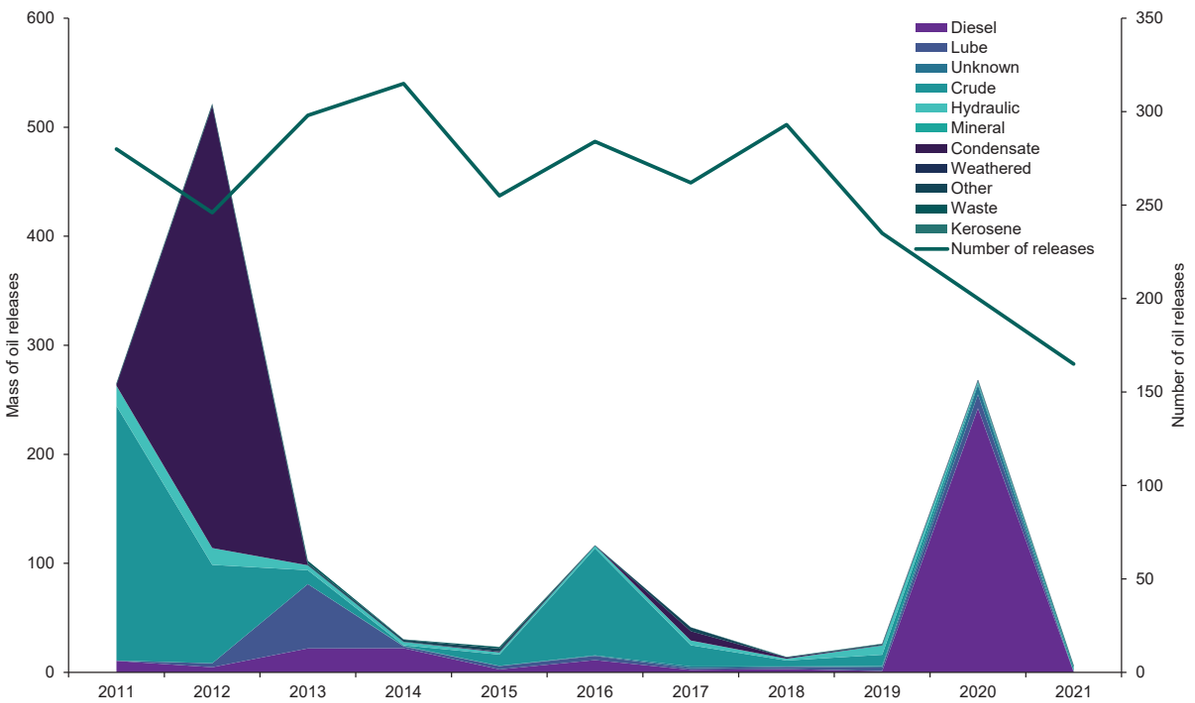
Determining the oil product type is an important element of an oil spill response: knowing how the release will behave in the marine environment under a range of conditions is critical to deciding how to respond.

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 the oil. If none of these approaches is possible the operator may actively protect sensitive areas of shoreline and also collect and recover any oil that does come ashore. As shown in Figure 13, crude oil was the commonest hydrocarbon type released in 2021, with 3.5 tonnes accounting for 57% of the total. There were 54 releases of hydraulic oil, adding up to less than 1 tonne, accounting for 15% of the total. Figure 14 shows the same data but for 2021 only.

Unintentional chemical releases

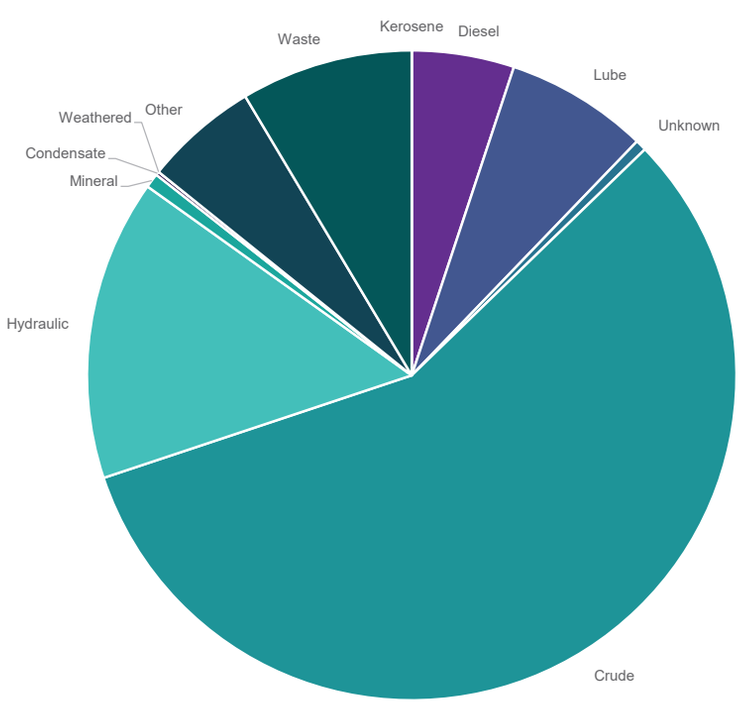
In 2021, 107 tonnes of chemicals were accidentally released in 211 incidents on the UKCS (*see Figure 15*). As noted earlier, most offshore chemicals are diluted and the reporting of releases by mass is not

Figure 13:
Unintentional oil releases by product type 2011-2021



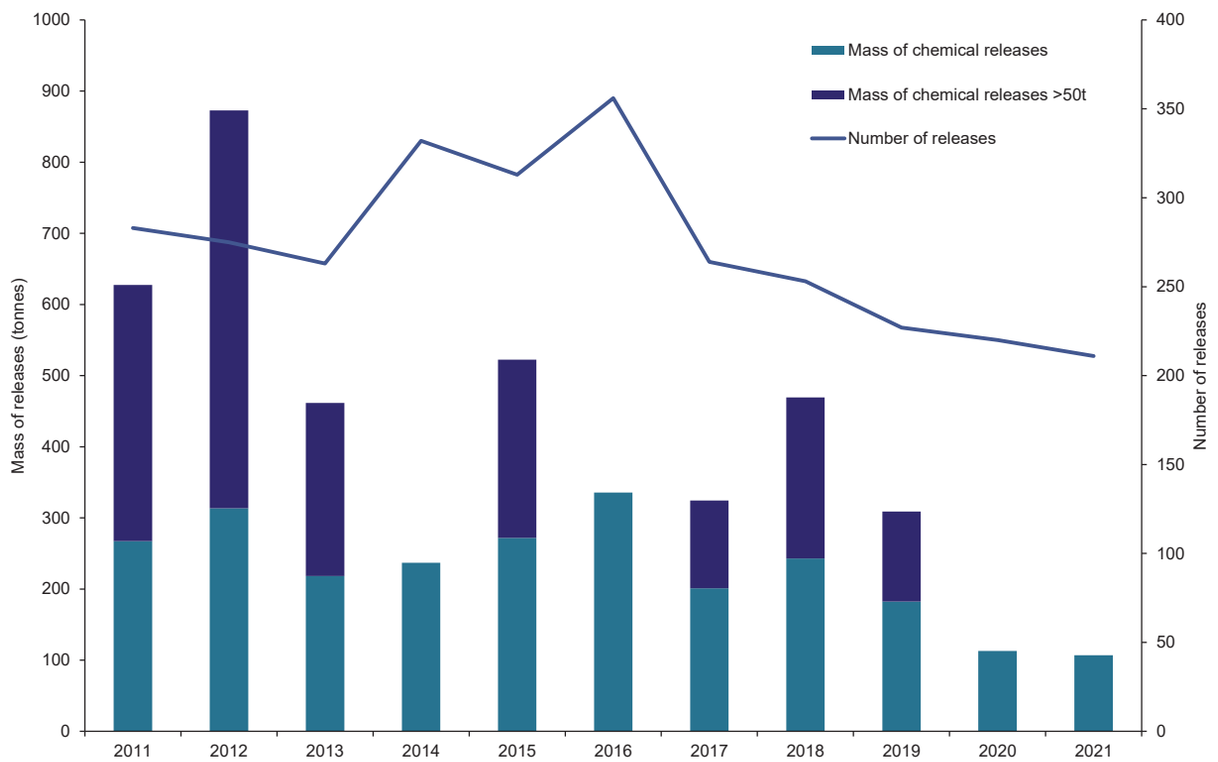
Source: OPRED, 2022

Figure 14:
Unintentional oil releases by product type (2021)



Source: OPRED, 2022

Figure 15:
Chemical releases



Source: OPRED, 2022

representative of the relative quantities of potentially environmentally harmful substances released to sea. In many cases, the largest single component of the chemicals accidentally released to sea is the water (H_2O) used as a solvent.

Releases by chemical hazard class and source

The chemical PON1 data were assigned hazard classes to show with greater clarity the potential impact on the marine environment. The CEFAS OCNS data [5] were used to produce the classifications detailed below.

Figure 16 shows that in 2021, 97% (163 tonnes) of all unintentional chemical releases on the UKCS fell into low and PLONOR while 0.4 tonnes of the mass released were ranked as high hazard: or 0.4% of the total.

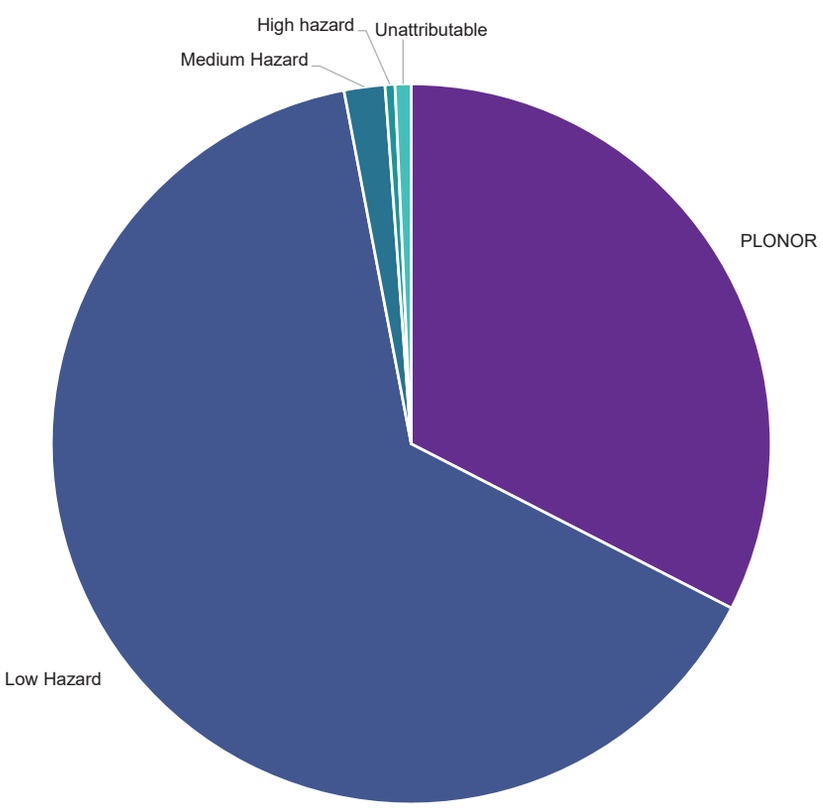
Figure 17 expands this to show releases across the 2011-21 period by hazard. During this time, 4,379 tonnes of chemicals were reported in PON1 on the UKCS, representing a total of 2,997 incidents. PLONOR and low-hazard chemicals make up the majority (4,369 tonnes; 80%) of the mass released. High and medium hazard chemicals contributed 4.7% (256 tonnes)

[5] 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

Table 1:
Hazard ranking used to categorise unintentional chemical releases

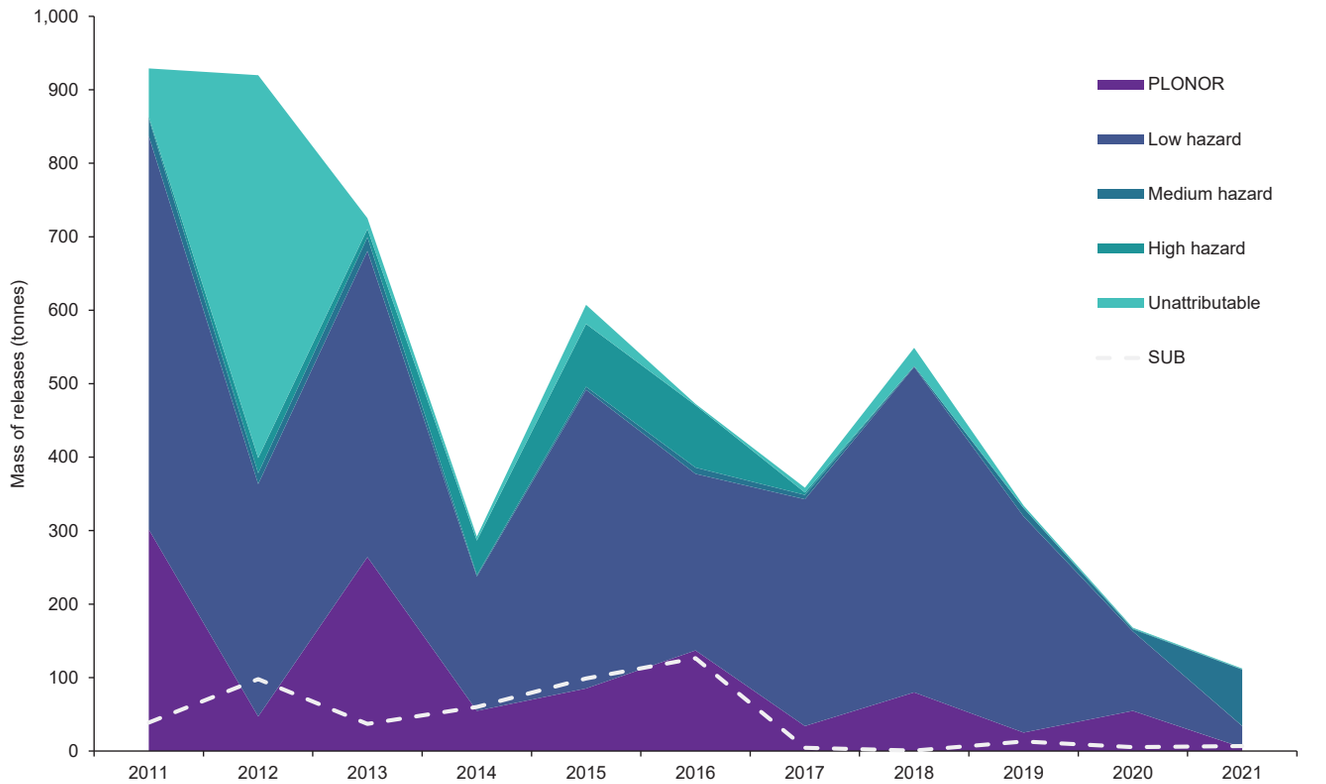
Hazard Ranking	Components
PLONOR	All those products for which PON1s were submitted that have been designated PLONOR status.
Low	OCNS groups D and E, gold and silver as the lowest ecotoxicity groupings. This excludes products that have official PLONOR rankings.
Medium	OCNS groups B and C as medium ecotoxicity groupings.
High	OCNS group A, as the highest ecotoxicity grouping.
Unattributable	All those products for which sufficient description is not given and therefore cannot be classed in this model.

Figure 16:
Total mass of chemical releases (by hazard)



Source: OPRED, 2022

Figure 17:
Mass of unintentional chemical releases (by hazard)



Source: OPRED, 2022

and 3.1% (169 tonnes) by mass, respectively. The remainder (671 tonnes; 12.3%) are "unattributable".

The total mass of chemicals unintentionally released fell about 80% from 2011 to 2021, down to 112 tonnes from 929.

Last year saw the lowest mass of chemicals accidentally released since 2011. The total number of incidents also decreased to 211, again the lowest since 2011. Accordingly, the average reported release size has fallen during the period, from 2.2 tonnes in 2011 to 0.5 tonnes in 2021.

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.

4 Safety

Keeping people safe is essential to everything that happens both on and offshore. Delivering the oil and gas that contributes so much to the UK's energy security is critical, but safe operations are always prioritised. Production is only permitted when the risks are understood and properly managed.

The industry continually strives to improve personal and process safety, using performance indicators to monitor how well this is being managed. Personal safety metrics point to industry's performance in managing the risks an individual faces. However, to minimise harm to people in a high hazard sector, there must also be continual focus on process safety. This means effective containment of hydrocarbons and associated hazards.

It is also important to manage the health and well-being of the offshore workforce effectively, given the remoteness of the worksite and the nature of the work they perform. Although production installations are well equipped to deal with generic medical emergencies, the sick-bay cannot provide all the facilities of a hospital. In poor weather conditions, it might not be possible to move a sick or injured individual to an accident and emergency facility for many hours.

The offshore helicopter operations that permit the movement of sick or injured people are also an integral part of keeping the basin producing safely. The safety risk associated with helicopter landing and take-off is closely managed at every stage of an installation's lifecycle, from design to decommissioning. Helicopter operators are highly focused on ensuring flight safety at all times.

The following section outlines the key performance indicators that combine to give a picture of how well all these aspects of safety were delivered in 2021.

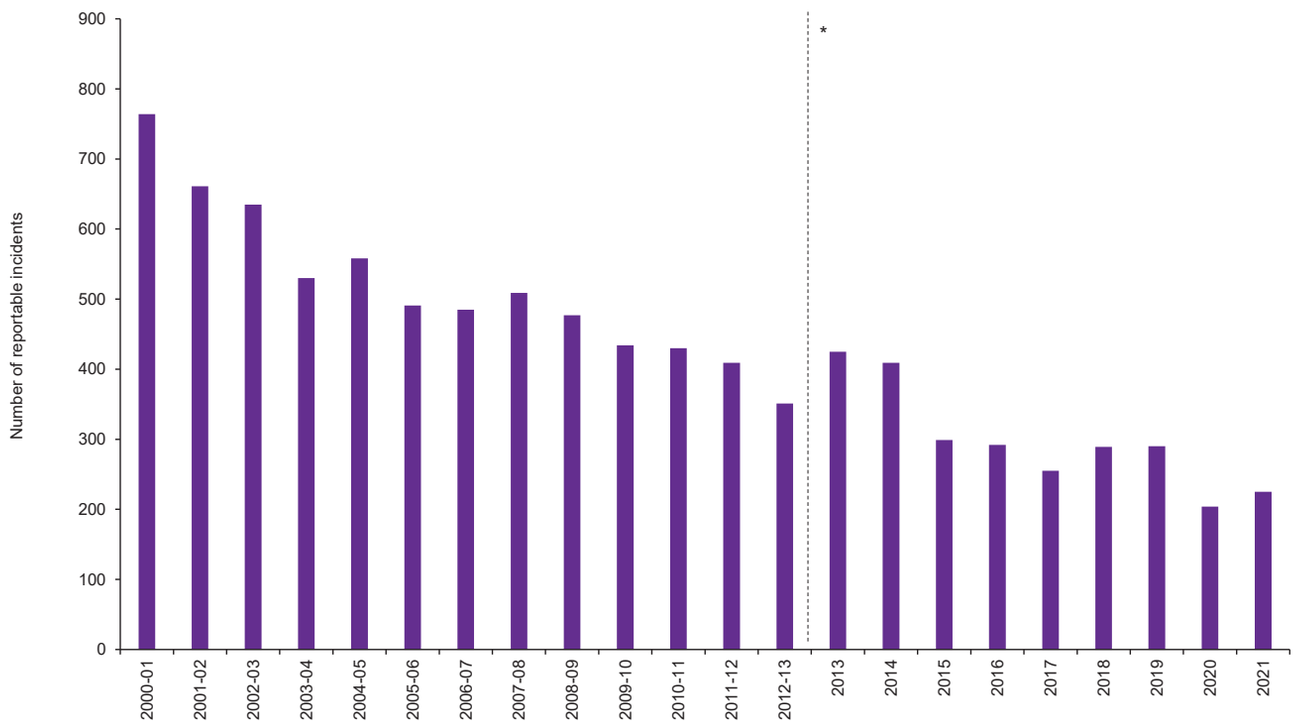
4.1 Process safety

Reportable Incidents

Hydrocarbon releases are the biggest single risk to be managed on offshore installations, but there are also other categories of incidents that could harm numerous individuals in a single event. These range from the loss of containment of hazardous substances to dropped objects. Collectively, these are managed as reportable incidents and are subject to two key pieces of legislation.

RIDDOR and the EU Offshore Safety Directive (OSD) Implementing Regulation No 1112/2014, transposed into UK law, define these reportable incidents. Under this legislation, defined incident types with high potential to cause significant injuries, termed dangerous occurrences, and other defined incidents such as failure of a safety critical element, must be reported to the HSE. All these incident types must be reported via the reporting of oil and gas incidents (ROGI) form as soon as possible, allowing the competent authority to decide what action might be necessary to prevent further harm and, in rare cases, to investigate where they suspect the duty holder may have failed to meet its duty of care under offshore legislation. The section below includes information on these reportable incidents, under both RIDDOR and OSD.

Figure 18:
ROGI reportable incidents



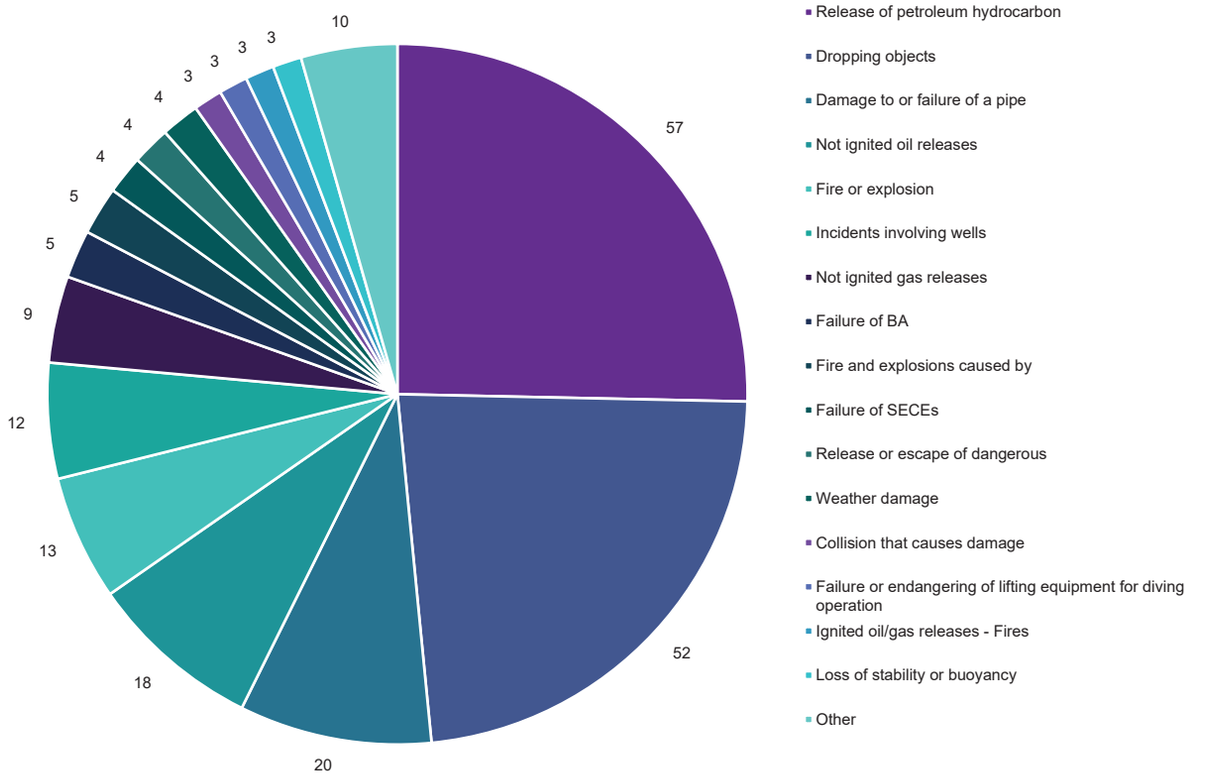
*Period of reporting changed from fiscal to calendar year

Source: Health & Safety Executive, 2022

As seen in Figure 18 below, there was a total of 225 reportable incidents in 2021, up from 204 in 2020 (up 10%). However, 2020 totals were a historic low as activites were minimal owing to the pandemic. Last year (2021) was the best year since the peak in 2000-01.

Figure 19 breaks down the reportable incidents by type. As in 2019 and 2020, HCR are the largest single type of reportable incident. These are considered in more detail in the section following. The next largest category is dropped objects, which increased by more than third, to 52 from 38 in 2020.

Figure 19:
Breakdown of ROGI reportable incidents



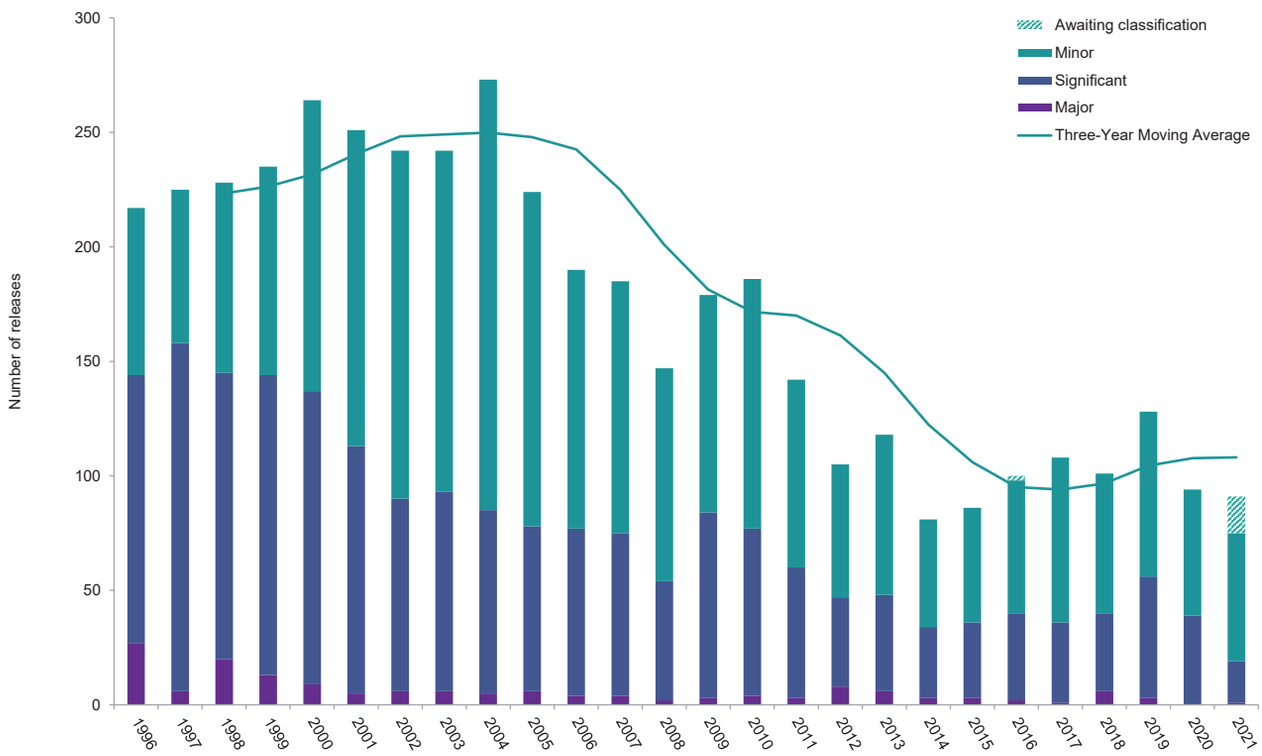
Source: Health & Safety Executive, 2022

Hydrocarbon releases

The HSE collates data on HCR, most of which are identified as such in the figure above. But it should be noted that “well incidents”, “pipeline incidents” and “fire or explosion” may also include HCR.

The HSE assigns a severity classification to RIDDOR-reportable HCR, defining them as minor, significant or major. A minor release has the potential to cause serious injuries or a fatality within the immediate vicinity but would not be expected to result in a multiple fatality event or significant escalation. A significant release is one with the potential to cause serious injury or fatality to personnel within the local area and to escalate within that local area – for example, by causing structural damage, secondary leaks or damage to safety systems – while a major HCR is one with the potential, if ignited, to cause multiple casualties or rapid escalation affecting, for example, other modules, the temporary refuge or escape routes. EU reportable releases are defined simply by volume or rate of release, rather than their potential to cause harm, which is why in the analysis below the two types of HCRs are clearly distinguished.

Figure 20:
Hydrocarbon releases occurring offshore



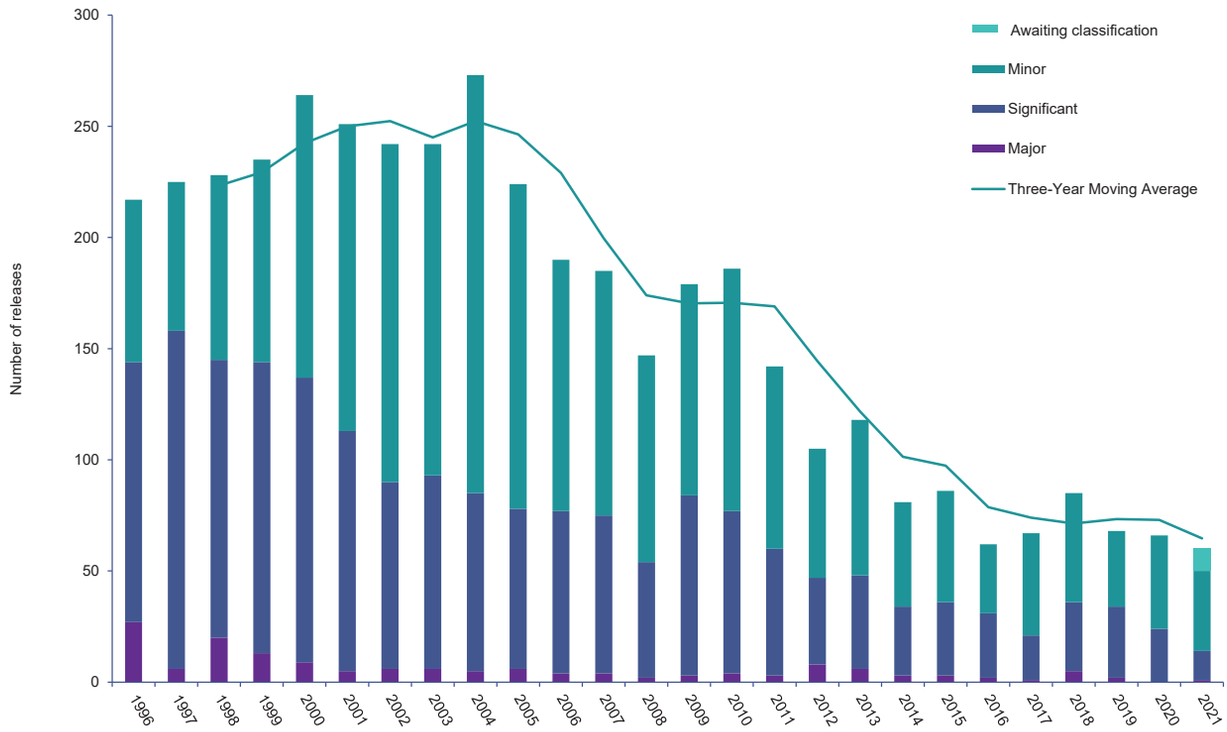
Source: Health and Safety Executive, 2022

Figure 20 shows the total number of reportable HCR in 2021, under RIDDOR and the OSD. There was a marginal decrease in HCR year on year in 2021 from 94 to 91.

Figure 21 shows the same data with the EU-reportable HCRs excluded to allow for proper historical comparison to the years before 2015 when OSD was introduced. RIDDOR reportable hydrocarbon releases are those deemed to have had the potential to escalate into an incident causing harm. In 2021, the total for RIDDOR releases decreased to 60 from 66, with one major release, 13 significant and 36 minor; 10 releases are yet to be classified.

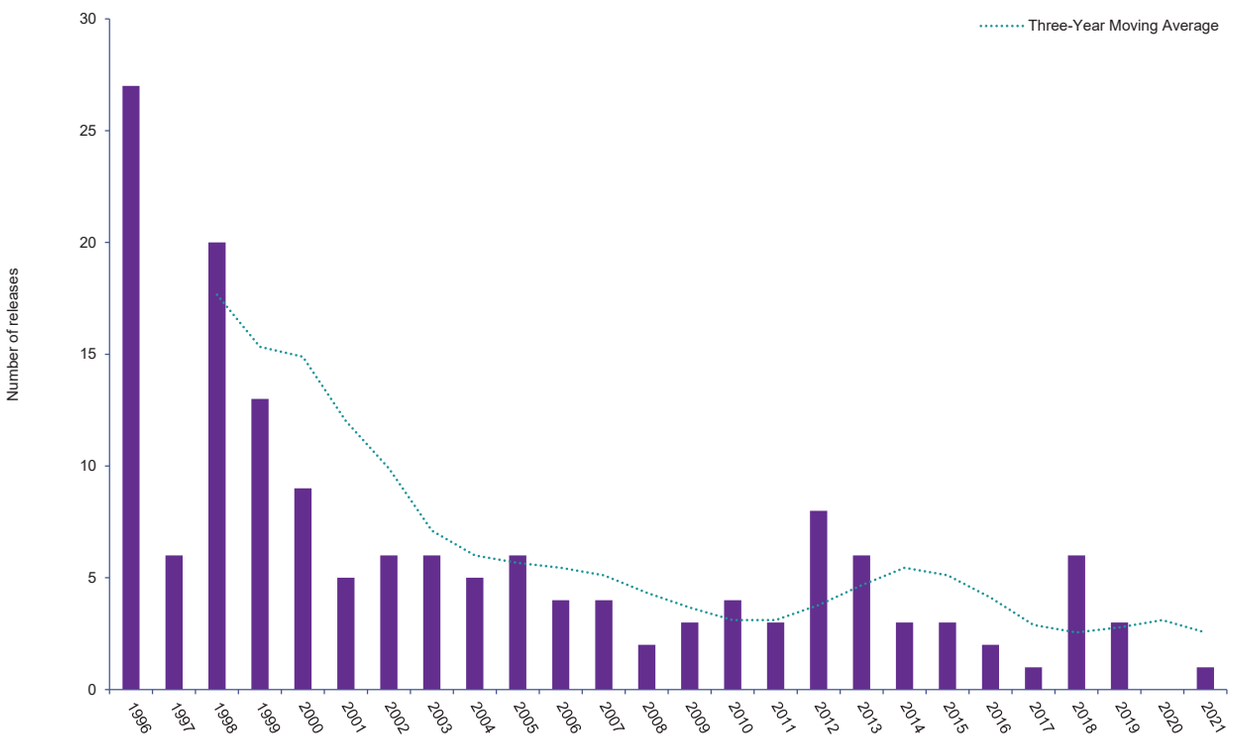
Figure 22 shows only the HCRs classified as major. So far, one major release has been confirmed, although several releases have yet to be classified. The number of major releases has declined in the last two decades, although the last couple of years could be considered anomalously low. This is due to less major project activity during the pandemic.

Figure 21:
RIDDOR reportable hydrocarbon releases



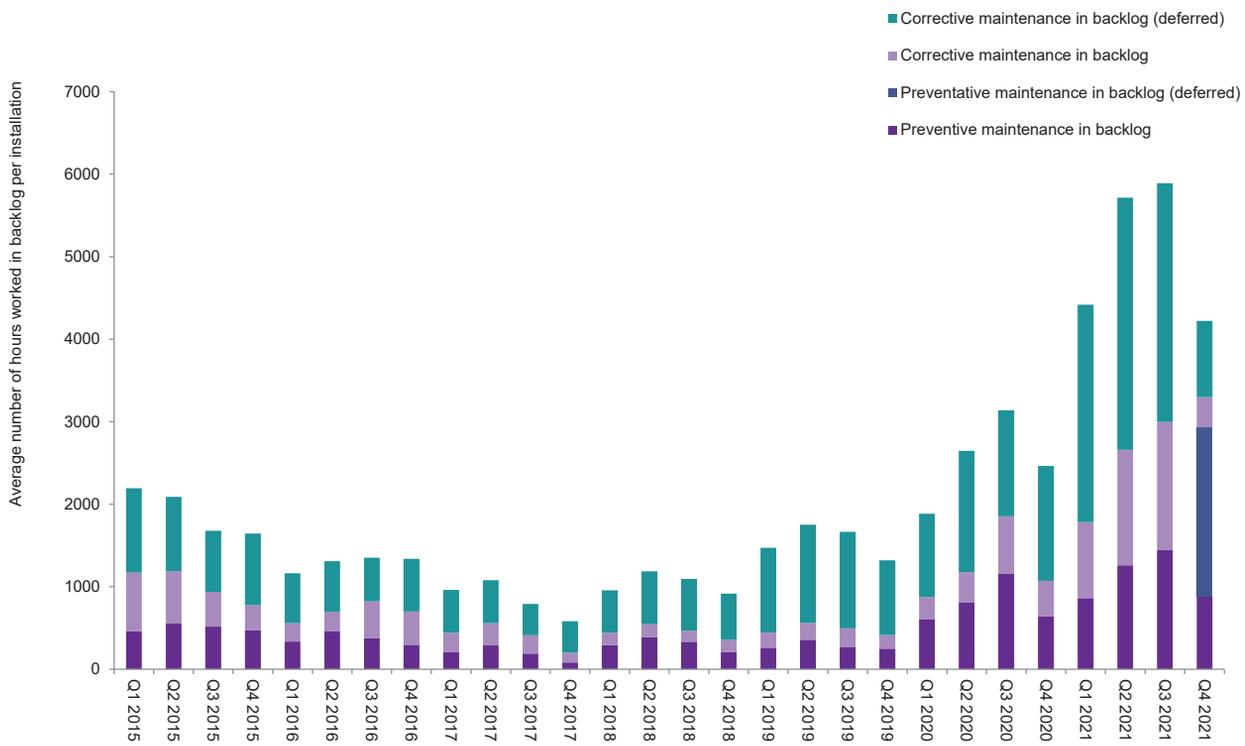
Source: Health & Safety Executive, 2022

Figure 22:
Major hydrocarbon releases



Source: Health & Safety Executive, 2022

Figure 23:
Safety and environmental critical element maintenance backlog



Source: OEUK, 2022

4.2 Maintenance

The UK offshore oil and gas industry has a voluntary asset integrity key performance indicator (KPI) scheme in place to monitor leading indicators using maintenance backlog and verification data, collected since 2008. The scheme is administered by OEUK, whereby the data are collected at the end of every quarter. Participation is voluntary, and the number of reporting installations varies, but in general, at least half of UKCS installations are included. Safety-critical maintenance backlog is one such KPI for process safety.

Figure 23 is a high-level snapshot of industry performance since the beginning of 2015. As shown, the overall safety critical maintenance backlog began to rise in 2018. However, until 2020, the backlog had remained below the peak seen in earlier years. The disruption to normal operations and the associated reduction in personnel on board (POB), necessitated by the pandemic, clearly affected total maintenance backlog levels in 2020 and 2021. In 2021 there was a marked increase in total maintenance backlog. An industry maintenance backlog reduction task finish was formed in 2021 and one output was an agreement on the categorisation and reporting of maintenance backlog. The drop in Q4 levels reflects a standardisation of backlog categorisation across industry that will allow monitoring throughout 2022. This will ensure that focus remains on reducing maintenance backlog given that the total maintenance backlog remains higher than in previous years. However the total maintenance backlog remains higher than in previous years.

4.3 Aviation

Helicopters remain a fundamental requirement for industry personnel working offshore, providing a means of transportation to and from installations and a rescue, recovery and medical evacuation (medevac) service.

As with all modes of transportation, helicopter travel is not without risk. Industry can never be complacent, having suffered four fatal accidents claiming 38 lives since 1997.

Current helicopter types

At the end of 2021, the working UKCS helicopter fleet numbered 69 aircraft and comprised a mix of medium and heavy twin-engine airframe types. Since 2001, only heavy and medium twin-engine helicopters have been used for commercial air transport (CAT) on the UKCS. This is because two-pilot, light helicopters do not meet today's commercial offshore range or payload requirements.

The fleet has been relatively stable since 2020. The helicopter types in active use for UKCS support (as of the end of 2021) are shown in the table below.

The Sikorsky S92 remained the predominant airframe type in 2021, carrying more than half of passengers visiting or leaving offshore installations. The H175 is second, carrying about one in four.

Offshore helicopter reportable accidents and serious incidents

In the seven years since the Sumburgh incident, there have been no fatal helicopter accidents in the UKCS sector, despite significant offshore activity. Performance over the last seven years would suggest that improvements in helicopter safety management are working. No accidents or serious incidents in 2021 mean that the UKCS is recording a rolling five-year fatal accident rate of zero for the fourth year running

Flying hours increased to over 63,000 in 2021, up from the low of 42,000 in 2020, but still well below pre-pandemic levels. Sectors flown were slightly lower, at 60,000, and there were around 565,000 passenger movements.

Table 2:
Current helicopter types used for UKCS offshore oil and gas support

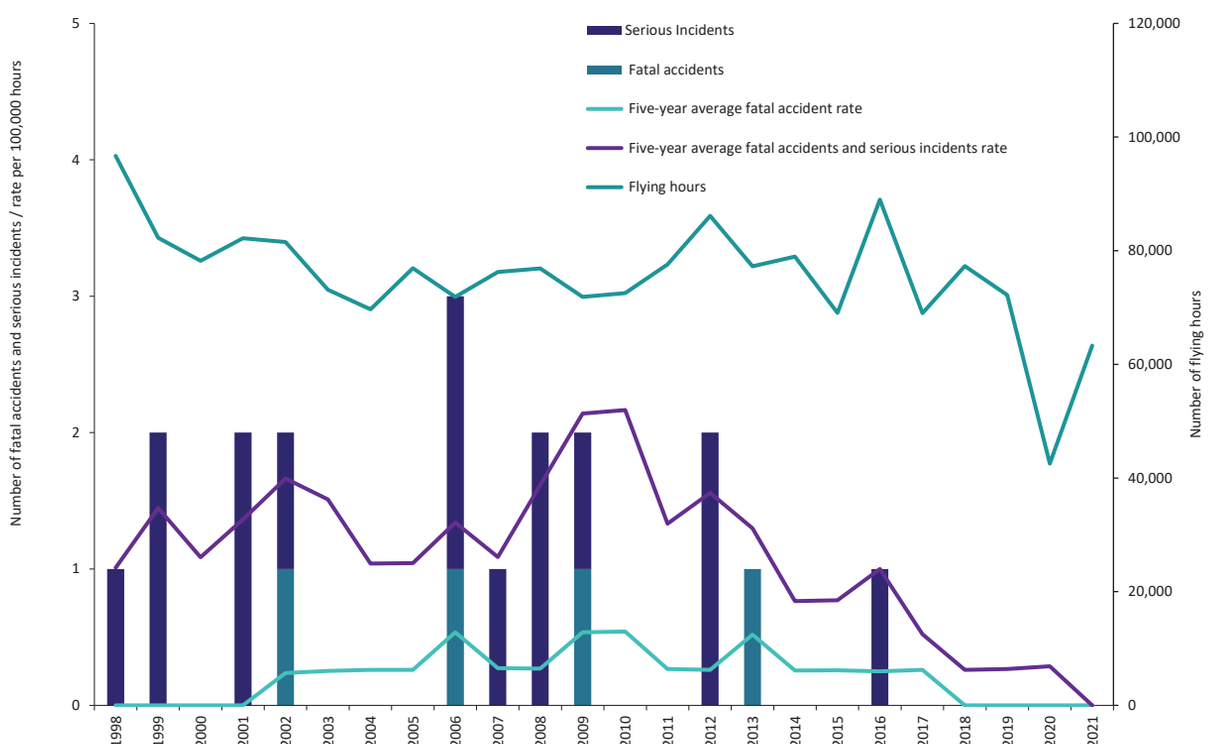
Type	Weight Class	Introduced	In Fleet
Leonardo AW139	Medium	2005	18
Leonardo AW169	Medium	2020	2
Leonardo AW189	Heavy	2014	1
Airbus H175	Medium	2016	16
Sikorsky S92	Heavy	2005	32

Helicopter accidents and serious incidents, as defined in Regulation (EU) No 996/2010, are reported to the Civil Aviation Authority (CAA). Since 1997, four fatal accidents have claimed the lives of 38 offshore workers and flight crew. Two were caused by catastrophic component failure and two were attributed to human factors. Sixteen reportable non-fatal accidents have also occurred since 1997. The causes include major component failures, pilot error, lightning strikes, major airframe damage and main and tail rotor damage. In most cases, only the helicopter was damaged but, on occasion these accidents have resulted in injury to personnel.

The rolling five-year average for fatal accidents has remained zero for the last four years, with the last fatal accident taking place in 2013.

Figure 24 illustrates the distribution of UKCS fatal accidents and serious incidents from 1998 to 2021, as well as fatal accident and serious incident rates/100,000 flying hours.

Figure 24:
Distribution of fatal accidents and serious incidents



Source: OEUK, 2022

4.4 Personal safety

Legally reportable injuries in the UK fall into two categories: those that result in seven or more days off work; and specified injuries and fatalities. Table 3 shows work-related fatalities at offshore installations recorded in over 25 years (excluding aviation, covered in a later section of this report). In 2021 there were none.

The total number of reportable injuries in 2021 was 64, of which 15 were specified injuries and 49 were over-seven-day injuries. To normalise data and permit comparison between years in which the number of people working offshore will change, this is given in the form of an injury rate as well as the absolute number of injuries.

In 2021 there was a marked increase in total maintenance backlog. An industry maintenance backlog reduction task finish was formed in 2021 and one output was an agreement on the categorisation and reporting of maintenance backlog. The drop in Q4 levels reflects a standardisation of backlog categorisation across industry that will allow monitoring throughout 2022. This will ensure that focus remains on reducing maintenance backlog given that the total maintenance backlog remains higher than in previous years.

The over-seven-day injury rate increased compared to 2020, up to 225 from 217 injuries/ 100,000 workers. As is clear on the graph, however, both the absolute number

Table 3:
Fatal injuries offshore

Year	Number of fatalities
1997–98	3
1998–99	1
1999–00	2
2000–01	3
2001–02	3
2002–03	0
2003–04	3
2004–05	0
2005–06	2
2006–07	2
2007–08	0
2008–09	0

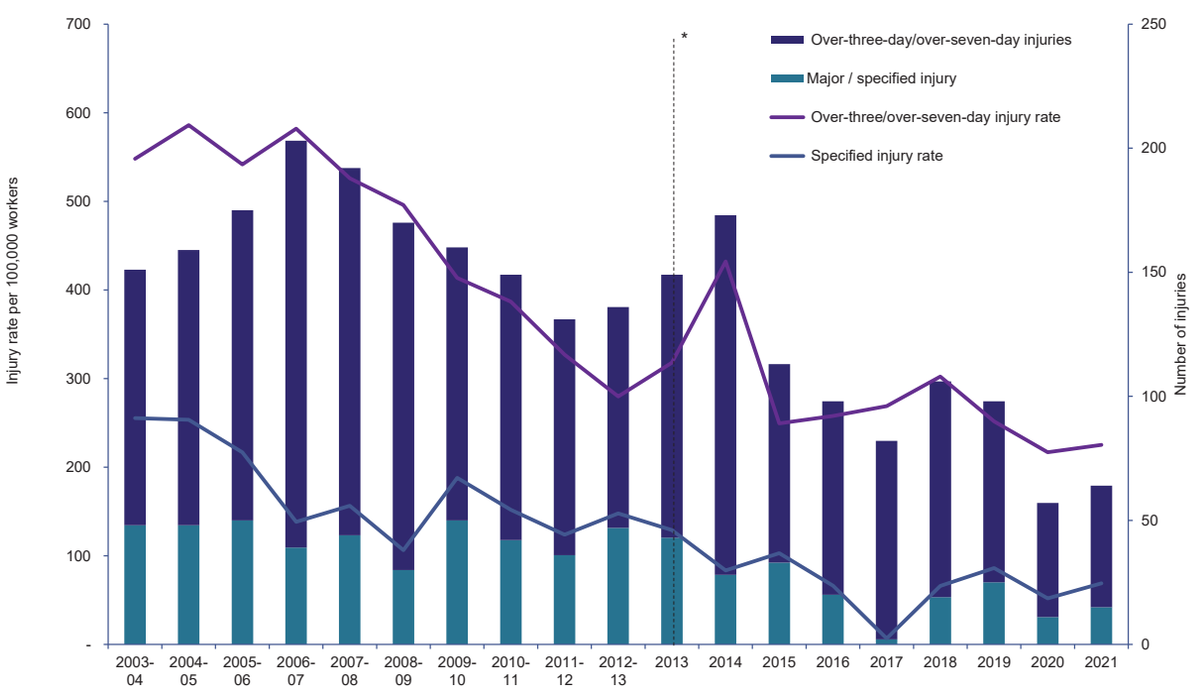
Year	Number of fatalities
2009–10	0
2010–11	0
2011–12	2
2012–13	0
2013–14	2
2015	0
2016	1
2017	0
2018	0
2019	0
2020	0
2021	0

and the rate of injuries in 2021 are lower than in most years of the last two decades. The specified injury rate also increased, from 52 to 69/ 100,000 workers, but similarly remains below the longer-term average.

Any injury sustained through work must always be considered too many, but it is important to track progress over time and recognise whether overall performance appears to be worsening or improving.
Bone fractures were the most common reportable injury, with 25 reported, followed by strains and sprains (17) and lacerations (10). The full breakdown of injury types is given in Figure 26.

The most common cause of injury was lifting and handling (18), followed by slips, trips and falls on the same level (16). A full breakdown of the type of accident involved in the injury is shown in Figure 27 below.

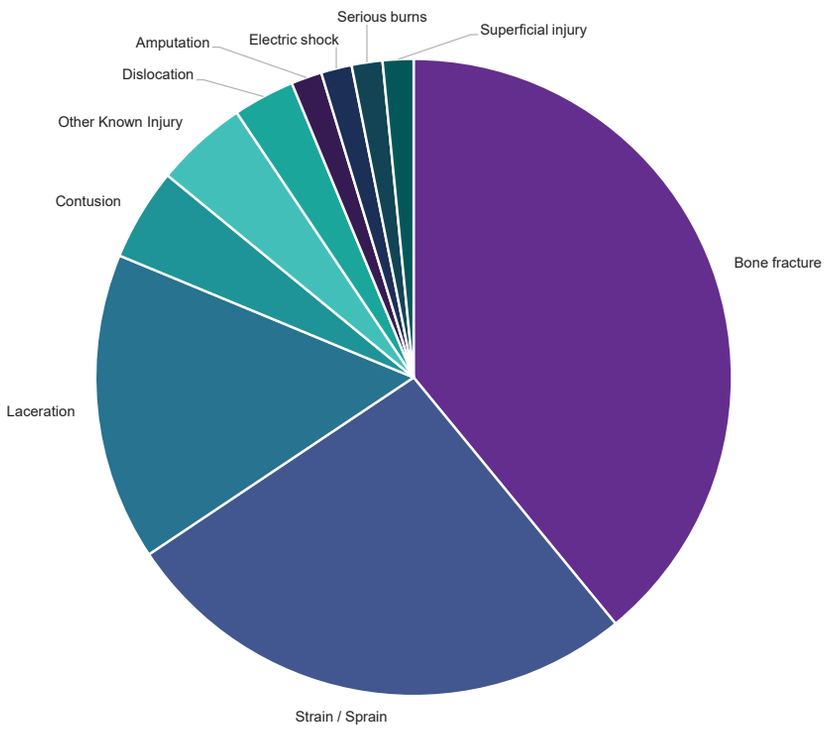
Figure 25:
Reportable injuries and injury rate per 100,000 workers



*Period of reporting changed from fiscal to calendar year

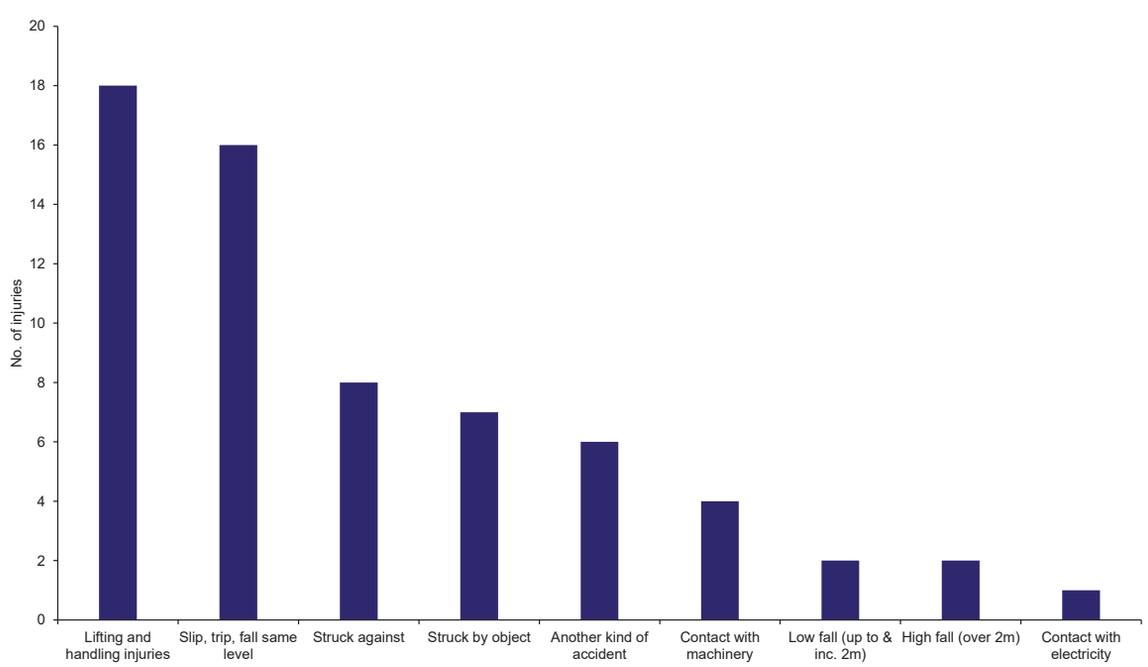
Source: Health and Safety Executive, 2022; Vantage POB

Figure 26:
Reportable injuries by type



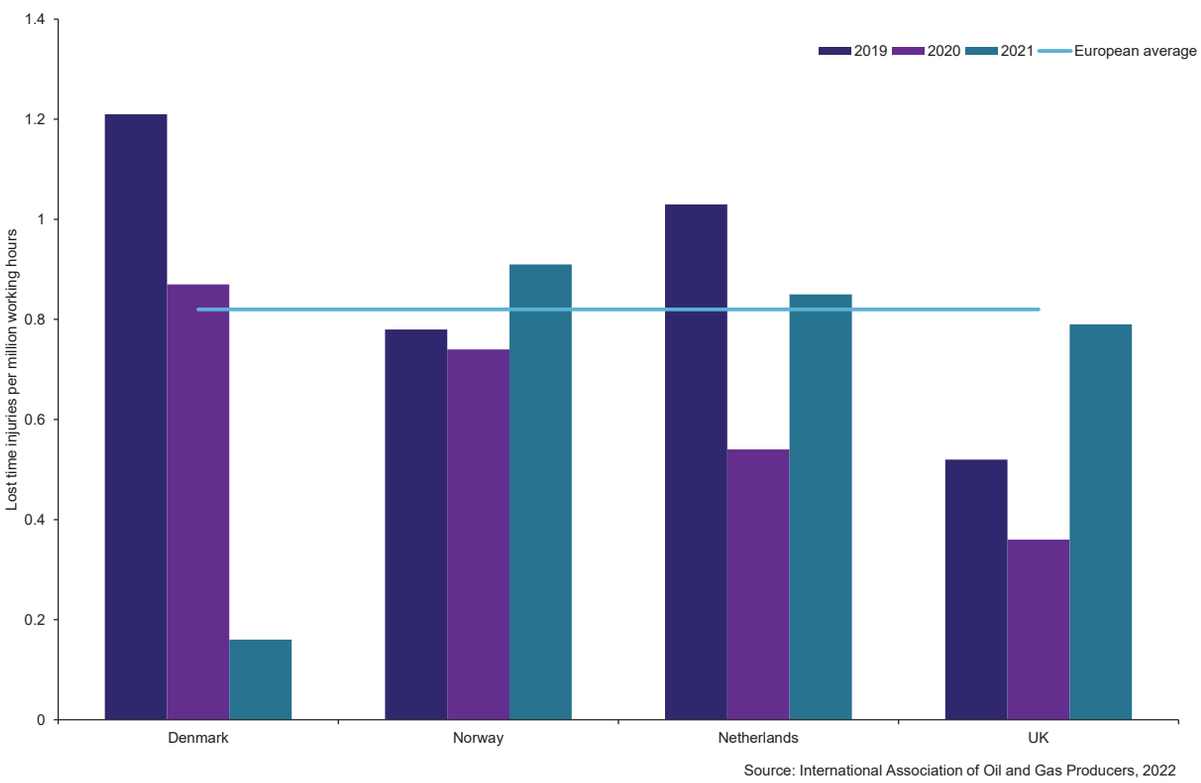
Source: Health and Safety Executive, 2022

Figure 27:
Reportable injuries by direct cause



Source: Health & Safety Executive, 2022

Figure 28:
Lost time injury frequency for oil and gas sectors neighbouring the UK



Source: International Association of Oil and Gas Producers, 2022

Figure 28 compares the UK offshore oil and gas industry's performance with other European offshore sectors, based on the lost-time injury (LTI) frequency data from the International Association of Oil & Gas Producers (IOGP).[6] LTI is an industry standard definition used to benchmark performance across different countries and companies, and is designed to give companies insight into injuries that are often not serious enough to require reporting to a safety regulator, but which can give insight into trends and predict future performance. This geographical comparison demonstrates that while the UK remains lower than the European average of 0.82/mn working hours, it has sustained a marked increase year on year. The UK had an LTI frequency that was slightly lower than its directly comparable peer in the North Sea, with 0.79 LTIs/mn working hours compared with 0.91 in the Norwegian sector.

[6] Note that IOGP reporting is a voluntary scheme for international energy companies and therefore does not include all UKCS operator activity. Source for IOGP: https://www.iogp.org/bookstore/product/safety-performance-indicators-2021-data/

5 Health

5.1 Medicals

A suite of occupational health-related legislation regulates the offshore working environment to control risks to health. In addition, it is industry policy that all persons working offshore are examined regularly by a medical professional before travelling offshore, at least once every two years. The registered examining doctors who conduct assessments in line with the OEUK medical standard help to ensure that each person is fit for work offshore.

Medical assessments can lead to four outcomes: unrestricted; limited duration; restricted; or failed. Doctors' returns include which of those outcomes were recorded, along with the reasons for those who did not receive an unrestricted certificate. Each year, doctors registered with OEUK return high-level data about the assessments they have conducted. Table 4 shows the number of medicals conducted and the number where individuals were not given a certificate. This dataset includes medicals conducted internationally.

In addition to the less than one percent who are assessed as not suited to working offshore, there are also individuals who receive an unrestricted limited duration certificate, designed for those with health conditions or issues that may require follow-up consultation before the usual two-year period; and those who receive a restricted certificate, which is for situations in which a health condition can potentially be managed successfully offshore, but only with the awareness and support of the installation operator.

Table 4:
Examining doctors statistics

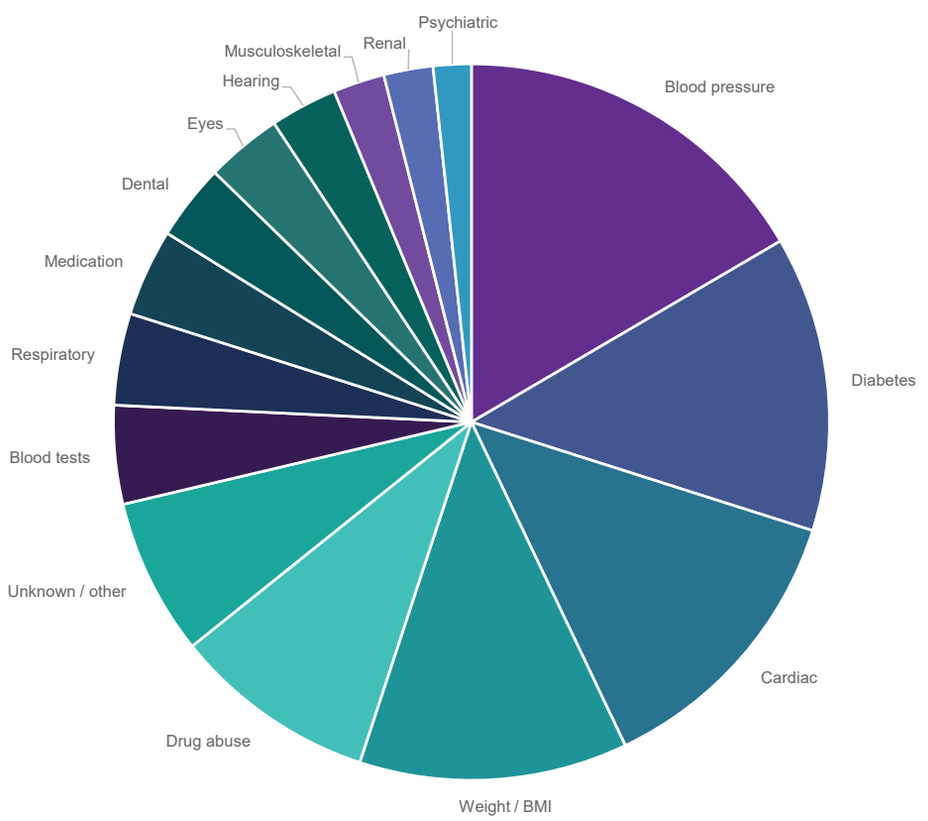
Year	Total number of medicals conducted	Number of medicals failed	Percentage medicals failed
2010	56,850	784	1.38%
2011	59,900	665	1.11%
2012	93,219	1,284	1.38%
2013	113,006	1,333	1.18%
2014	118,597	1,285	1.08%
2015	111,651	1,125	1.01%
2016	99,104	1,125	1.14%
2017	110,688	1,339	1.21%
2018	127,474	1,298	1.02%
2019	146,479	1,463	1.00%
2020	111,647	1,082	0.97%
2021	111,612	1,074	0.96%

In 2021, more than 2,000 restricted and 5,000 limited duration medical certificates were issued.

A breakdown of the medical assessment results, shown in Figure 29, identifies the reasons for failing. Issues with blood pressure are most common, with over 15% of failed medicals attributed. Diabetes and cardiac issues are the second and third most common overall, at around 12% each.

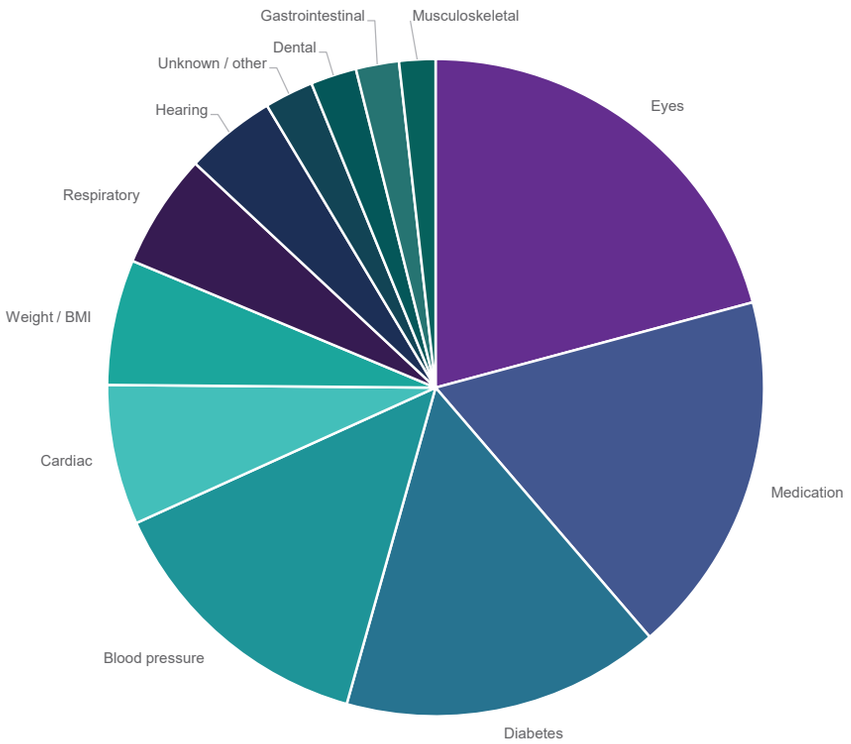
In Figures 30 and 31 below, a similar breakdown is given for those receiving limited duration and restricted certificates.

Figure 29:
Proportion of failed assessments by cause



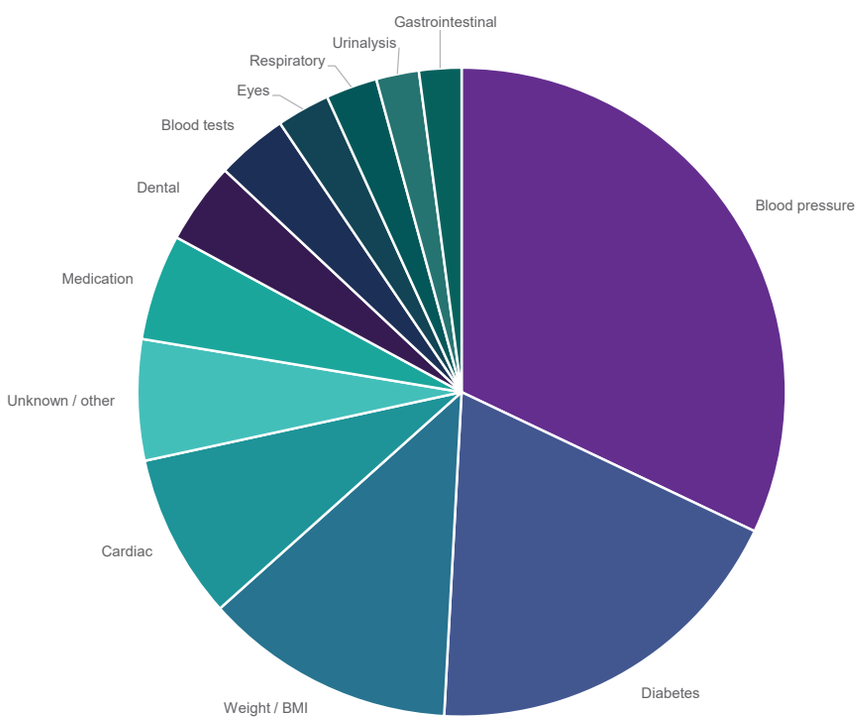
Source: OEUK, 2022

Figure 30:
Reasons for restricted certificates



Source: OEUK, 2022

Figure 31:
Reasons for limited duration certificates



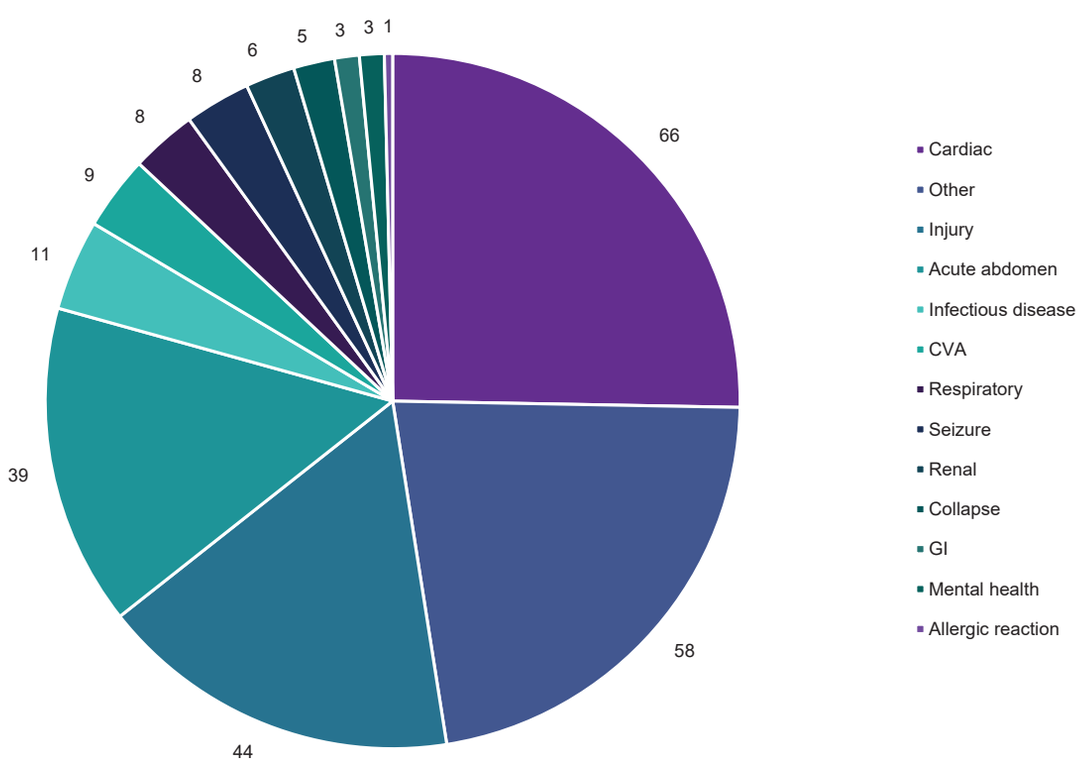
Source: OEUK, 2022

5.2 Medevac

Even with the medical assessment to identify and mitigate possible health risks, it is not possible to ensure no illness occurs offshore. As a remote and potentially hazardous workplace where support from the usual emergency services is not available, offshore installations are required to have medical facilities to allow the medic, supported by a topsides doctor, to provide appropriate medical treatment and care to injured or ill personnel until they can be returned to shore. For less acute conditions or minor injuries, this may mean the person is simply treated onboard and continues to work the rest of the rota on normal or restricted duties. For some personnel, the appropriate route may be to wait until the next scheduled flight, but where onshore treatment is a matter of urgency, the industry and coastguard search and rescue (SAR) helicopters are used.

In 2021, emergency medevacs were requested a total of 261 times, with peak demand during the months of May and August (28 for both months). These medevacs were completed using industry and coastguard SAR helicopters. As shown in Figure 32, the most common reason was a suspected cardiac incident, closely followed by injury and acute abdominal issues. This is in line with the previous years' data. The 'other' category included a variety of reasons including vertigo, skin rash, amnesia and swollen limbs.

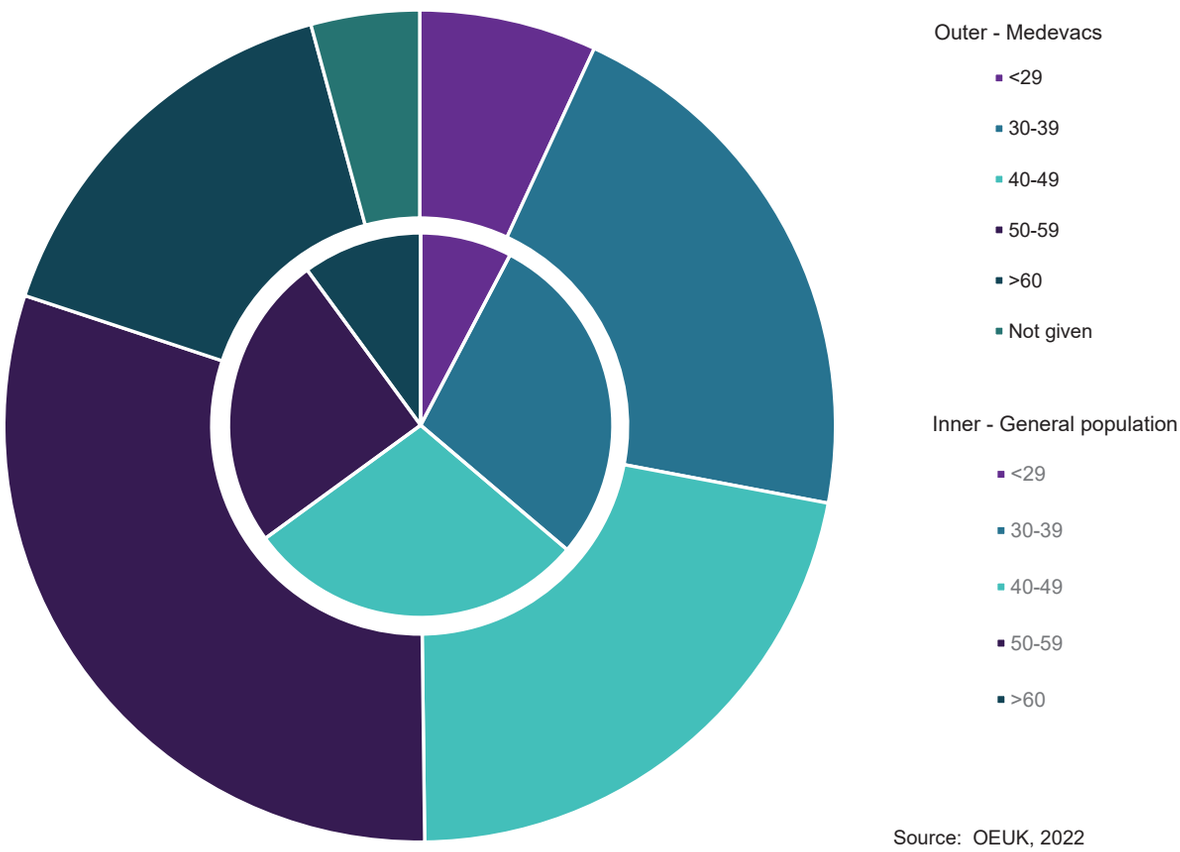
Figure 32:
Reasons for emergency medical evacuations



Source: OEUK, 2022

Figure 33 shows the breakdown by age for emergency medevacs and the breakdown by age for the whole offshore workforce. The 30-39 year-olds and the 40-49 year-olds represented 57% of the overall workforce and 43% of all medevacs. The proportion of medevacs associated with the 50-59 and 60 years and older groups accounts for 46% of all medevacs but only 35% of the total offshore population.

Figure 33:
Proportion of medevac and general offshore population by age group



Source: OEUK, 2022

Glossary

A&E	Accident & Emergency
Anaerobic digesters	Micro-organisms that break down biodegradable material in the absence of oxygen
BEIS	Department for Business, Energy & Industrial Strategy
Bq	Becquerel
Bunding	A retaining wall for safety or environmental purposes
CAA	Civil Aviation Authority
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CH_4	Methane
CO	Carbon monoxide
CO_2	Carbon dioxide
Dangerous occurrences	Certain specified events as defined in RIDDOR 2013, including dropped objects, HCR, fires or explosions
Discharge	A permitted disposal of substances offshore
Duty holder	In relation to a production installation, this means the operator, and in relation to a non-production installation, the owner
EEMS	Environmental Emissions Monitoring System
Flaring	The controlled burning of natural gas in the course of oil and gas production operations
GHG	Greenhouse gases
HCR	Hydrocarbon release(s)
HMCS	Harmonised Mandatory Control Scheme
HSE	Health and Safety Executive
IOGP	International Association of Oil & Gas Producers
KPI	Key Performance Indicator
Lagging indicator	Output oriented measurement of past performance
Leading indicator	Input oriented prediction of future performance
mn boe	Million barrels of oil equivalent

N_2O	Nitrous oxide
NORM	Naturally occurring radioactive materials
NO_x	Nitrogen oxides
NSTD	North Sea Transition Deal
OCNS	Offshore Chemical Notification Scheme
OMAR	Offshore Major Hazard Regulator
OPEP	Oil Pollution Emergency Plan
OPRED	Offshore Petroleum Regulator for Environment and Decommissioning
OSD	Offshore Safety Directive
OSPAR	The Oslo/Paris Convention for the protection of the marine environment of the North East Atlantic
Over-seven-day injuries	Accidents that cause an employee to be away from work or unableto perform their normal work activities for more than seven consecutive days
Personal safety	Protecting an individual from harm
PLONOR	Pose Little Or No Risk – used by OSPAR to classify substances used and discharged offshore
PON1	Petroleum Operations Notice 1
Process safety	Managing major hazards that could lead to multiple casualties, such as fires, explosions or structural collapse
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
Release	An unintentional discharge of oil or chemicals
SO_x	Sulphur oxides
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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