SUMMARY REPORT 2020

THE NORWEGIAN CONTINENTAL SHELF

Trends in risk level in the petroleum activity

RNNP 2020

Preface

Trends in risk level in the petroleum activity (RNNP) concern all the parties involved in this industry, and are also of general interest. The RNNP is an important tool for helping to establish a common picture of developments in selected conditions which affect risk. That gives it a particularly significant role in the petroleum sector's tripartite arenas, which in turn makes ownership of the process and the results by the parties important.

The petroleum industry has considerable health, safety and environmental (HSE) expertise, and this is a critical success factor for an activity such as the RNNP. We are therefore very pleased that the parties in the industry contribute actively to the work, along with key personnel from operator companies, vessel owners, helicopter operators, consultancies, research and teaching.

Stavanger, 2 March 2021

Finn Carlsen,
Director of professional competence, PSA

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1. Purpose and limitations

1.1 Purpose

The project 'trends in risk level' on the Norwegian continental shelf (NCS) started in 1999. Its background was the need of the parties – employers, employees and government – to clarify uncertainties related to the safety consequences of the major structural changes undergone by the petroleum industry in the late 1990s.

A selection of indicators has traditionally be used by the industry to illustrate safety trends in the petroleum activity. Indicators based on the frequency of lost-time incidents have been particularly widespread. It is generally accepted that this only covers a small part of the overall safety picture. In recent years, the trend has been towards using more indicators to review trends. It is important for the parties in the industry to establish methods for measuring the effects of its overall safety work.

In this report, the Petroleum Safety Authority Norway (PSA) wants to establish a description of important aspects of conditions affecting risk, based on sets of information and data from the industry, in order to be able to measure the effect of overall safety work in the sector.

1.2 Purpose

The purpose of the work is to:

- measure the effects of HSE work in the industry
- help to identify areas which are critical for HSE and where efforts to identify causes must be prioritised to prevent undesirable incidents and accidents
- increase insight into possible causes of accidents and their relative significance for the risk profile in order to provide decision support for the industry and the government concerning preventive safety and emergency preparedness planning.

This work could also help to identify priority areas for regulatory amendments, research and development.

1.3 Key limitations

Attention in this report is focused on personal risk, which here includes both major and occupational accidents. Use is made of reactive and proactive indicators, both qualitative and quantitative in nature.

The work is restricted to matters included in the PSA's area of authority with regard to safety and the working environment. All passenger transport by helicopter is also included, in cooperation with the Civil Aviation Authority Norway and the helicopter operators on the NCS. The following areas are covered:

- all production and mobile facilities on the NCS, including subsea facilities
- passenger transport by helicopter between heliports and facilities
- use of vessels within the safety zone around each facility.

Data from onshore plants in the PSA's administrative area are included from 1 January 2006. Data collection started from that date, and separate reports have since been published. Outcomes and analyses for onshore plants and the results from these are not included in this summary report. An annual report with the spotlight on acute spills to the sea from offshore petroleum activities has been published since 2010. The next report on acute spills is due in the autumn of 2021.

2. Conclusions

Through the RNNP, the PSA seeks to measure trends in safety, the working environment and the natural environment using a number of indicators. Evaluations are based on the triangulation principle – in other words, assessing developments by using several instruments which measure trends for factors which affect risk.

In an indicator-based model, some indicators – particularly in areas with relatively few near-misses – can be expected to display large annual variations at times. Trends are therefore the main focus. A positive development for near-misses may indicate that the industry's risk-management efforts are having an effect, but such an assessment provides no guarantee that future incidents will be avoided. The petroleum industry, particularly in view of the ambition voiced by the Storting (the Norwegian Parliament) that Norway's petroleum industry will be the world leader in HSE, should therefore devote constant attention to effective management of conditions which affect risk.

No data for indicators of noise, the chemical working environment or ergonomic risk factors have been reported for 2020. Unfortunately, the development of new indicators in collaboration with the industry is taking longer than expected.

Ideally, a summary conclusion should be reachable on the basis of information from all the measurement instruments used. This is complicated in practice, partly because the information used reflects HSE conditions at very different levels.

Major accidents

No accidents resulting in fatalities occurred in 2020, and thereby no major accidents as these are defined in this report. As in 2019, no exceptionally serious near-misses with the potential for many fatalities were recorded either.

The number of near-misses with major accident potential has exhibited an underlying positive trend since 2005. There were 38 such incidents (excluding helicopters) in 2020, down slightly from preceding years but on a par with the past eight. When the number of incidents is normalised against working hours, however, their frequency in 2020 was significantly lower than the average for 2010-19. Statistically speaking, this means that the reduction in this period is very probably (more than 90 per cent) real.

Five non-ignited hydrocarbon leaks were recorded in 2020 (six in 2019), the lowest number recorded. Three leaks above one kilogram per second (kg/s) were recorded. Six years have now passed without recording a hydrocarbon leak above 10 kg/s. There were 10 well control incidents in 2020, all in the lowest risk category. Although this was fewer than in 2019, the frequency of such incidents in 2020 – once normalised against the number of wells drilled – was within the expected range. Eleven incidents of damage to structures and maritime systems which satisfy the damage criteria used in the RNNP were recorded in 2020, a marked increase from five in 2019.

Weighting near-misses with major accident potential by factors which identify their inherent potential for causing fatalities were they to develop further makes the total indicator for 2020 rather higher than the year before. This reflects the increase in structure-related incidents, which contribute a relatively high weighting. As with near-misses, the total indicator has shown an underlying positive trend since 2005. Because particularly serious incidents are assigned a relatively high risk weighting, the annual variation in the total indicator is large. But the positive trend is nevertheless clear. The total indicator is a composite which reflects the industry's ability to influence and manage a number of risk-related factors. Its underlying positive trend indicates that the industry has got better at managing factors which affect risk. Although an indicator based on historical figures gives some relevant information about conditions influencing future risk, it by no means provides sufficient data on future risk.

Helicopter risk comprises a relatively large share of overall risk exposure for workers on the NCS. The risk indicators used in this work are intended to capture the risk associated with incidents and to identify opportunities for improvements.

Over the period when the RNNP has collected helicopter-related data, the Turøy crash in 2016 is the only fatal accident which falls within the scope of this study.

The helicopter expert group's assessment of incidents in 2020 classified two of them in the most serious category. The expert group found that no barriers remained in either of these incidents. One was an operational incident at night, where the helicopter lost height on take-off to a level below the helideck and this was not noticed until visual contact was established with the rig. The other related to a high wave which hit the vessel without warning right after landing, before passengers had left the helicopter, and caused the helideck to move sharply.

Barriers

The industry is making increasing use of ”leading” indicators, which can say something about robustness for withstanding incidents. Barrier indicators are an example of these. In part, this type of indicator describes the ability of the barriers to function when required. Barrier indicators show that major differences in level persist between facilities. A positive trend has been seen over time for a number of barriers which have exceed the industry's self-defined requirements, but the level has been fairly stable in recent years. Nevertheless, failures appear to be increasing for some barriers, with leak testing of riser valves showing a clear rise in recent years. Barrier indicators for downhole safety valves (DHSVs) and blowdown valves (BDVs) are also above the industry's expected level. It is a matter of concern that important safety valves intended to control and limit energy in connection with incidents score below the industry level when the NCS is assessed overall.

Data on maintenance management have been collected for more than a decade. Hours of preventive and corrective maintenance on the fixed facilities declined in 2020 to the lowest figure for reported hours in the 2012-20 period. Figures show that the total backlog in preventive maintenance is high and on a par with 2013. The backlog for HSE-critical preventive maintenance has remained more or less stable throughout the period. Hours of total outstanding corrective maintenance showed a considerable increase in 2020 compared with the year before.

The data for mobile facilities show variations in the backlog of preventive maintenance and in outstanding corrective maintenance. That corresponds with what the PSA has seen in recent years. A number of facilities failed to carry out HSE-critical preventive maintenance and corrective maintenance in accordance with their own deadlines.

Personal injuries and accidents

In 2020, 191 reportable personal injuries were recorded on the NCS, compared with 234 the year before. Twenty-five were classified as serious in 2020, down from 33 in 2019.

A downward trend prevailed in 2010-13. Developments have been more variable since 2014, with the frequency of serious personal injuries per million working hours fluctuating. An overall decline occurred from 2019 to 2020. Serious personal injuries per million working hours fell on mobile facilities but increased on production facilities. The change is not statistically significant when viewed against the preceding 10-year period.

In-depth study: reporting incidents and near-misses to the PSA

This study has taken a closer look at the scope, causes and consequences of erroneous and inadequate reporting to the PSA. Measures have been identified which can be assessed in order to improve reporting in the industry. The channels investigated were reporting to the PSA, notifying/reporting hazard and accident situations and reporting personal injuries.

The overall picture indicates good reporting and notification of incidents to the PSA. Results show that the scope of erroneous and inadequate reporting is limited, and that confidence can be placed in the incident reports included in the RNNP. The data suggest that all incidents with genuinely serious consequences are notified to the PSA.

An improvement potential still exists. The study shows that the biggest information loss relates to personal injuries and the reporting of these via the Norwegian Labour and Welfare Administration (NAV) forms. Considerable underreporting occurs here. Moreover, the results indicate that near-misses and less serious personal injuries go unreported in certain cases. At the same time, a fairly widespread perception exists among employees that reports of accidents and hazardous conditions are moderated.

Four improvement areas are identified: strengthening the reporting culture internally and between companies, better reporting of personal injuries and use of the NAV form, preparing a common basis for classifying incidents, and improved practice for notifying/reporting hazards and accident situations.

Questionnaire-based survey for divers

A questionnaire-based survey was conducted with diving personnel on the NCS for the second time in 2020. Everyone participating in diving operations on the NCS during the year was invited to complete the questionnaire, which was by and large the same as one used in the regular survey of offshore personnel but with some adjustments.

Divers and diving supervisors responded more positively on most of the working environment questions than they did in 2018. They found the use of Norsok saturation decompression tables to be extremely advantageous. Generally speaking, the divers took a more positive view of working environment conditions than the supervisors.

The divers and supervisors were asked to assess risk in a number of areas, and differences from 2018 were generally small. Supervisors assess risk as somewhat higher for "human errors during diving operations", "personal diving equipment (including bail-out)", "fatigue" and "manual control system failures". The supervisors perceived the risk related to these areas as somewhat higher than the divers did, with the biggest differences for "fatigue" and "bell located over structure".

Little variation is found in responses on how supervisors assessed safety behaviour. Those aspects receiving the most negative assessment related to whether they were concerned about safety during diving operations and to time pressure. With two exceptions, all the safety-related questions directed at the divers were assessed more positively than in 2018. The divers also experienced less time pressure than the supervisors, and less than in 2018.

All diving personnel were asked to answer questions on the safety climate. Their responses revealed few changes from 2018. The statement which attracted the biggest change in responses was also the one with the largest number of negative responses of all the statements. This concerned being sufficiently rested when the respondent is at work. One of the other individual statements which received a negative assessment is "reports about accidents or dangerous situations are often moderated."

There were no significant changes in the assessment of accident risk from 2018 to 2020. The hazard and accident situations considered most dangerous were helicopter accidents, emissions/discharges of toxic gases/substances/chemicals, serious work accidents and dropped objects.

Where the physical, chemical and ergonomic working environment is concerned, responses show relatively few changes from 2018 to 2020. The exposures most frequently experienced are "work in cold areas exposed to the weather" and "heavy manual lifting".

Diving personnel took a more negative view of their quality of sleep than in 2018, but the changes are not statistically significant. They also experienced more health complaints than in 2018, and those most of them reported are “fatigue”, “back pain”, “neck/ shoulder/arm pain”, “joint discomfort” and “ringing in the ears/tinnitus”.

3. Execution

Results from the RNNP are presented in annual reports. This report covers 2020. Work on it was primarily carried out from December 2020 to March 2021.

The detailed objective for 2020 was to:

- continue the work carried out in previous years
- maintain and develop the total indicator method
- conduct a questionnaire-based survey
- improve the model for barrier performance in relation to major accidents
- evaluate correlations in the datasets.

3.1 Execution of the work

The following players contributed to the work on this year’s report.

• PSA:	Responsible for execution and further development of the work
• Operator companies and shipowners:	Contribute data and information about activities on the facilities
• Helicopter operators:	Contribute data and information about helicopter transport
• HSE specialist group (selected specialists)	Evaluates the procedure and input data, gives views on developments, evaluates trends, proposes conclusions
• Safety Forum: (tripartite)	Comments on the procedure and results, and recommend further work
• Advisory group: (tripartite)	Interparty group to advise the PSA on further development of the RNNP work.

The PSA's working group comprises: Øyvind Lauridsen, Mette Vintermyr, Tore Endresen, Arne Kvitrud, Narve Oma, Morten Langøy, Trond Sundby, Inger Danielsen, Elisabeth Lootz, Roar Høydal, Jan Ketil Moberg, Bjarte Rødne, Audun S Kristoffersen, Hans Spilde, Semsudin Leto, Eivind Jåsund, Kenneth Skogen, Bente Hallan and Torleif Husebø.

The following external parties have assisted the PSA with specific assignments:

- Terje Dammen, Jorunn Seljelid, Torleif Veen, Irene Buan, Jon Andreas Rismyhr, Trond Stillaug Johansen, Jon Tolaas, Mads Lindberg, Ragnar Aarø, Kristine Nesvik, Reidun Værnes, Mahdi Ghane, Rune Haugen Larsen, Eivind Tunheim and Silje Frost Budde, Safetec
- Astrid Schuchert, Olaug Øygarden and Leif Jarle Gressgård from the Norwegian Research Centre (Norce).

The following people have contributed to the work on indicators for helicopter risk:

- Øyvind Solberg, John Arild Gundersen, Norwegian Oil and Gas through the aviation network (LFE)
- Morten Haugseng and Ole Morten Løge, CHC Helikopter Service
- Martin Boie Christiansen, Kjetil Hellesøy and Tor Bryne, Bristow Norway AS

A large number of other people have also contributed to the work.

3.2 Use of risk indicators

Data have been collected for hazard and accident situations related to major accidents, occupational accidents and working environment factors, namely:

- Defined situations of hazards and accidents (DSHAs) in the following main categories:
  - uncontrolled discharges of hydrocarbons, fires (in other words, process leaks, well incidents/shallow gas, riser leaks and other fires)
  - structure-related incidents (in other words, structural damage, collisions and collision risk)
- test data associated with the performance of barriers against major accidents on the facilities, including data on well status and maintenance management
- accidents and incidents in helicopter transport
- work accidents
- other hazard and accident situations with less extensive consequences or less significance for emergency preparedness.

The term ”major accident” is used in many places in the reports. No unambiguous definitions of this term exist, but the following are often used and coincide with the base definition utilised in this report:

- a major accident is an accident (in other words, entailing a loss) to which at least three to five people may be exposed
- a major accident is an accident caused by the failure of one or more of the system's built-in safety and emergency preparedness barriers.

Given the major accident definition in the Seveso II directive and in the PSA's regulations, the definition used here is closer to a ”large accident”.

Data collection for the DSHAs related to major accidents builds in part on existing databases in the PSA (Codam, DDRS and so forth), but also to a significant degree on information acquired in cooperation with operator companies and shipowners. All incident data have been quality-assured by checking them, for example, against the incident register and other databases in the PSA.

Table 3.1 provides an overview of the 20 DSHAs in use and which data sources are utilised. The industry applies the same categories for registering information through databases such as Synergi.

Table 3.1 Overview of the primary sources for data on incidents

DSHA	*Description*	*Database*
1	Unignited hydrocarbon leak	Industry
2	Ignited hydrocarbon leak	Industry
3	Well incidents/loss of well control	PSA
4	Fire/explosion in other areas, not hydrocarbon	Industry
5	Ship on collision course	Industry
6	Drifting object	Industry
7	Collision with field-related vessel/facility/shuttle tanker	PSA
8	Damage to a facility's structure, stability/anchoring/positioning failure	PSA/industry
9	Leak from riser, pipeline and subsea production facility*	PSA
10	Damage to riser, pipeline and subsea production facility*	PSA
11	Evacuation	Industry
12	Helicopter incidents	Industry
13	Man overboard	Industry
14	Occupational accidents	PSA
15	Work-related illness	Industry
16	Full loss of power	Industry
18	Diving accident	PSA
19	H_2S emission	Industry
20	Crane and lifting operations	PSA/industry
21	Falling objects	PSA/industry

* Also includes wellstream pipeline, loading buoy and loading hose where relevant.

3.3 Developments in the level of activity

Figures 3.1 and 3.2 present the trend in 2005-20 in the parameters used to normalise against the activity level for production and exploration activities (all figures are relative to 2005, which has been set as 1.0). Appendix A to the main report (PSA, 2020a) presents the underlying data in detail.

Working hours on production facilities declined by 13 per cent from 2019 to 2020. Mobile facilities witnessed an increase of around 14 per cent from the previous year. The number of exploration and production wells drilled also declined significantly.

Production volume rose slightly from 2019.

A presentation of DSHAs or contributors to risk can sometimes vary according to whether absolute or "normalised" values are specified, depending on the normalisation parameter. In the main, normalised values are presented.

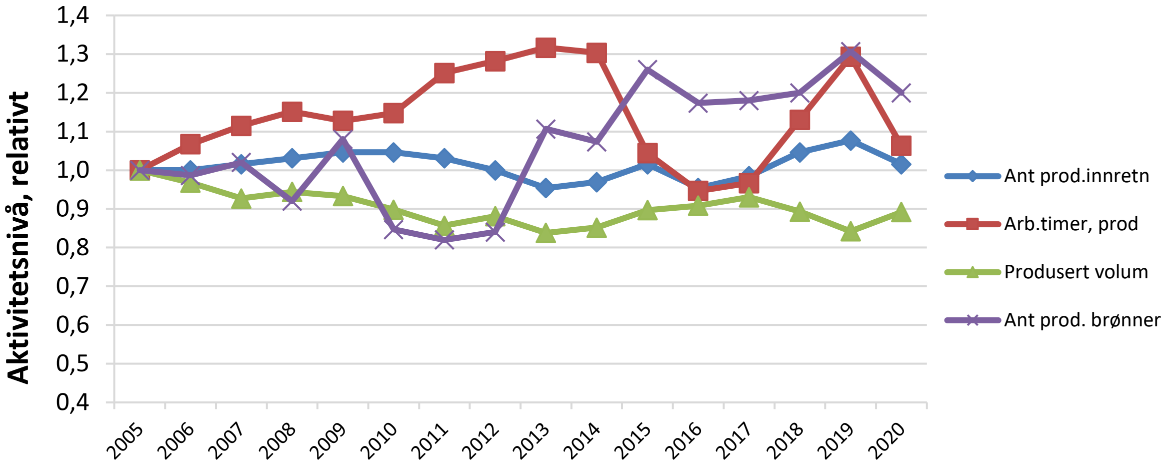

Figure 3.1 Relative trend in activity level for production facilities. Normalised against 2005.

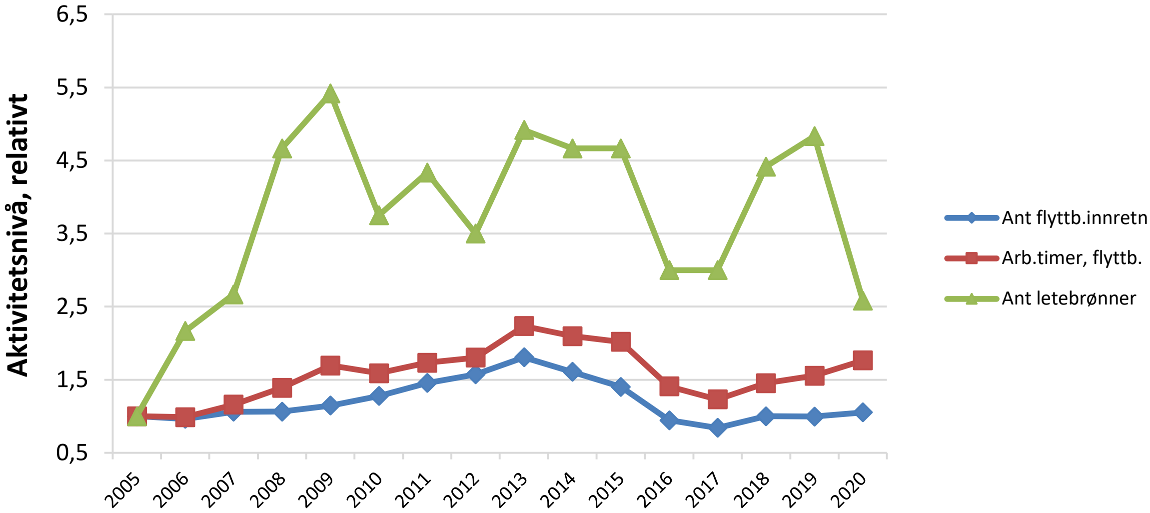

Figure 3.2 Relative trend in activity level for mobile facilities. Normalised against 2005

A corresponding activity overview for helicopter transport is shown in sub-section 4.1.

3.4 Documentation

Analyses, assessments and results are documented as follows:

- summary report – NCS in 2020 (Norwegian and English versions)
- main report – NCS in 2020
- report on onshore plants in 2020
- report on acute spills to the sea for the NCS in 2020, published autumn 2021
- methodology report, 2021

These reports can be downloaded from the PSA's website (www.ptil.no/rnnp).

4. Status and trends – helicopter incidents

Cooperation with the Norwegian Civil Aviation Authority and the helicopter operators in work on risk indicators continued in 2020. Aviation data obtained from the helicopter operators concerned include incident type, risk class, severity, type of flight, phase, helicopter type and information about departure and arrival.

4.1 Activity indicators

Figure 4.1 presents activity indicator 1, which includes the volume of flight hours and passenger flight hours per annum for 2005-20. The sharp reductions in flight hours and passenger flight hours from 2014-16 reflect the decline in hours worked on the NCS.

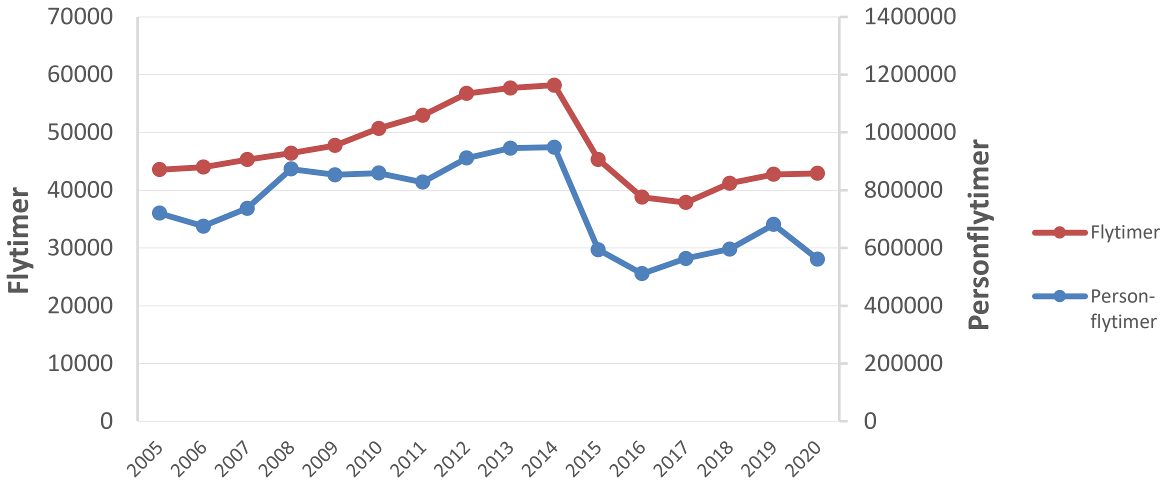

Figure 4.1 Flight hours and passenger flight hours per annum, 2005-20

The annual volume of helicopter flights must be viewed in relation to the level of activity on the NCS. See the main report. Passenger numbers fell by 40 per cent in 2014-16, passenger flight hours declined by 47 per cent and working hours were down by 28 per cent. This means fewer people stayed for short periods on the facilities, and a larger proportion than before were on the facilities for a full 14 days.

4.2 Incident indicators

4.2.1 *Incident indicator 1 – serious incidents and near-misses*

Figure 4.2 shows the number of incidents included in incident indicator 1. From 2009 (and retrospectively for 2006-08), the most serious near-misses which the companies reported were reviewed by an expert group comprising operational and technical personnel from the helicopter operators, the oil companies and the PSA's project group in order to classify these incidents on the basis of the following categories.

Little remaining safety margin against fatal accident: *no remaining barriers*
Medium remaining safety margin against fatal accident: *one remaining barrier*
Large remaining safety margin against fatal accident: *two (or more) remaining barriers*.

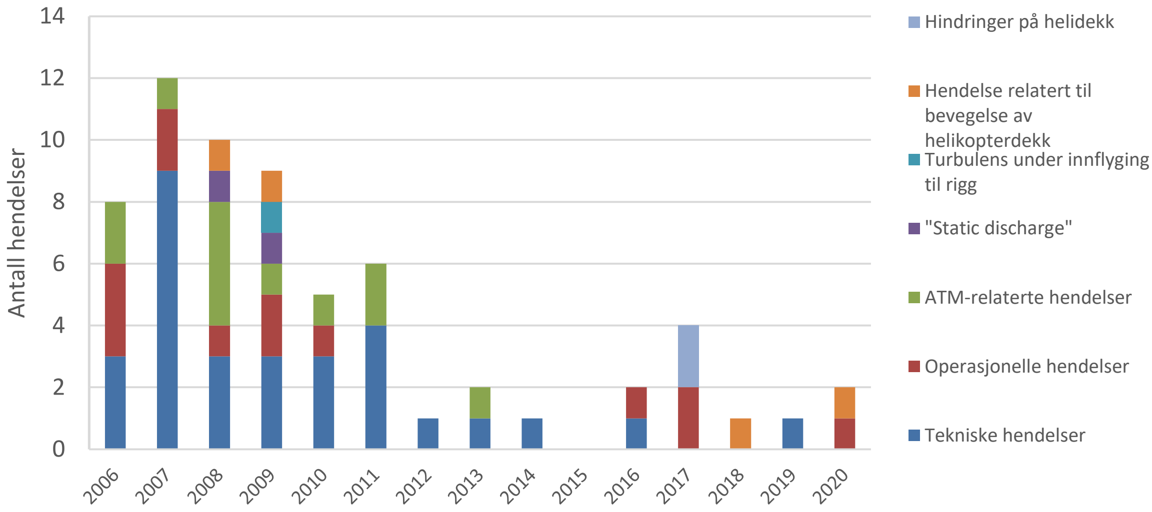

Figure 4.2 Incident indicator 1 per annum by causal categories, not normalised, 2006–20

The expert group's assessment of incidents for 2020 identified two incidents with no remaining barrier which were included in incident indicator 1. One was an operational incident at night, where the helicopter lost height on take-off to a level below the helideck and this was not noticed until visual contact was established with the rig. The other related to a high wave which hit the vessel without warning right after landing, before passengers had left the helicopter, and caused the helideck to move sharply.

5. Status and trends – indicators for major accidents on facilities

The indicators for major accident risk from previous years have been retained, with the main emphasis on indicators for incidents and near-misses with the potential to lead to a major accident (DSHAs 1-10). Indicators for DSHA 12, helicopter incidents, are presented separately in chapter 4. Barriers against major accidents are presented in chapter 6.

There have been no major accidents, as defined in this report, on facilities on the NCS since 1990. The serious incident on *COSL Innovator* in 2015, when a wave stove in windows in the quarters section, injured four people and killed another, is categorised as a structure-related incident and is the first major accident DSHA to have caused a fatality in the 2005-20 period. The last time fatalities occurred in connection with a major-accident DSHA was in 1985, when a shallow gas blowout occurred on the *West Vanguard* mobile facility. In addition come the Norne and Turøy helicopter accidents of 1987 and 2016.

5.1 DSHAs associated with major accident risk

Figure 5.1 presents the trend for reported DSHAs in 2005-20. It is important to emphasise that this figure does not take account of the potential for loss of life from near-misses. Incidents showed a rising trend in 1996-2000, which has been discussed in reports for previous years and is therefore omitted from the figure. After an apparent peak in 2005, the number of incidents with major accident potential has gradually decreased. Reported incidents in 2018 were at the lowest level recorded for the period. Their number declined somewhat from 2019 to 2020, primarily owing to fewer well-control incidents.

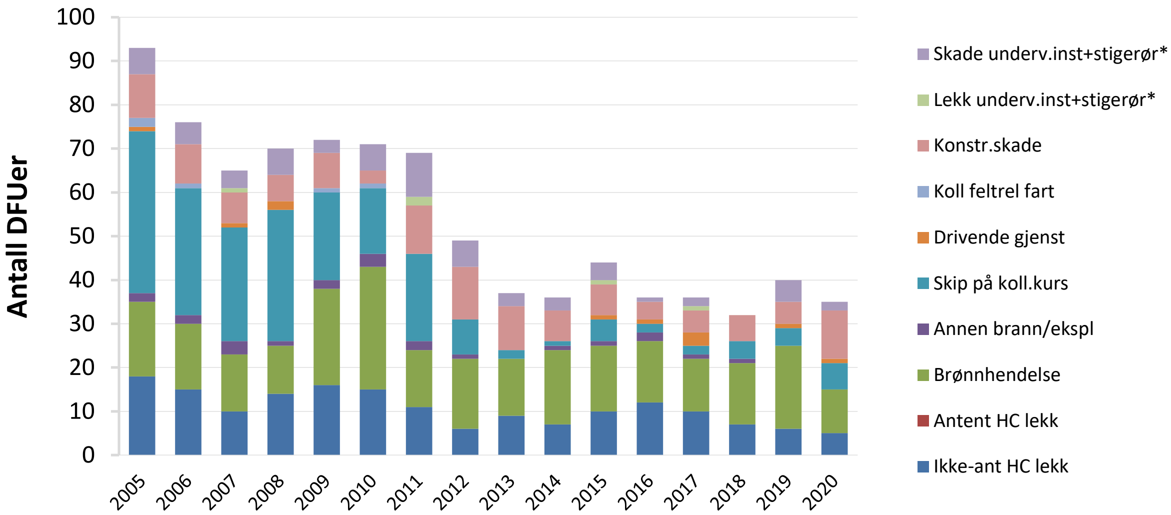

Figure 5.1 Reported DSHAs (1-10) by categories
****Within the safety zone***

Figure 5.1 presents the number of incidents without normalisation against exposure data. Figure 5.2 shows the same overview, but now normalised against working hours. As in the two preceding years, the 2020 value is below the hatched area. This means it is significantly below the average for the previous 10 years.

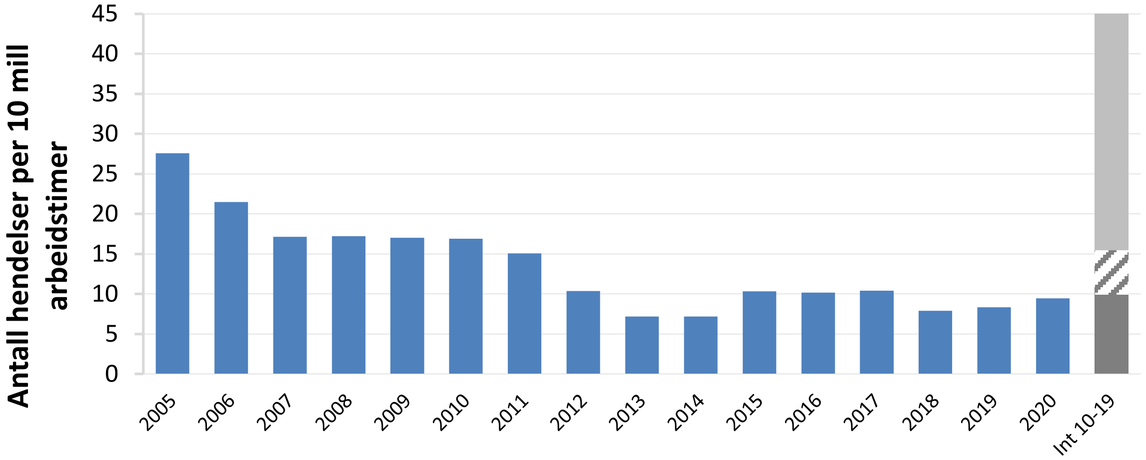

Figure 5.2 Total DSHA 1-10 incidents normalised against working hours

5.2 Risk indicators for major accidents

5.2.1 Hydrocarbon leaks in the process area

Figure 5.3 presents hydrocarbon leaks greater than 0.1 kg/s in 2005–20. Five leaks with a rate above 0.1 kg/s were registered in 2020, with two in the 0.1-1 kg/s category and three in the 1-10 kg/s category.

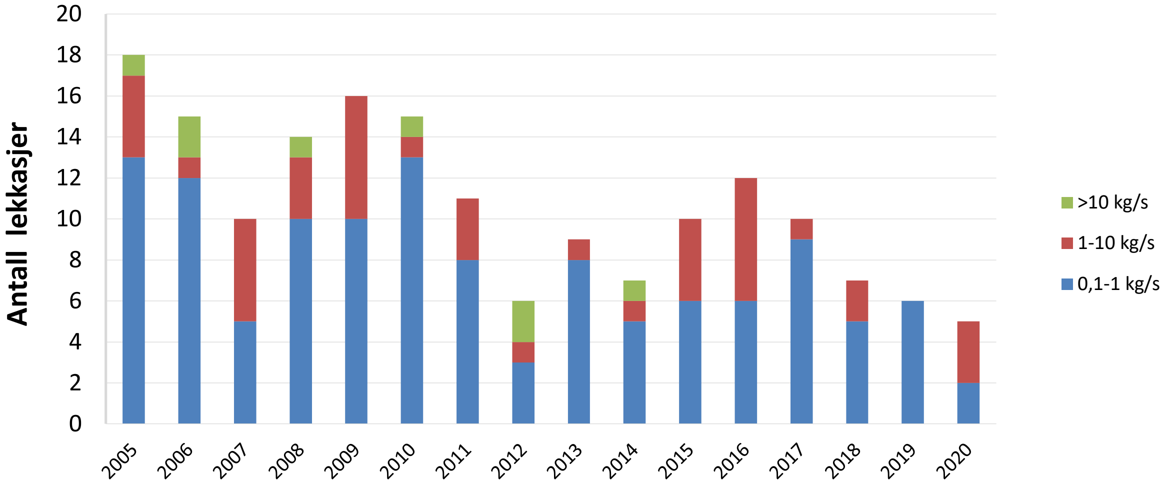

Figure 5.3 Hydrocarbon leaks exceeding 0.1 kg/s, 2005-20

Figure 5.4 presents the number of leaks when these are weighted in accordance with their assessed risk potential. Put simply, the risk contribution of each leak can be said to be roughly proportional to its rate in kg/s. The risk contribution in 2020 is the second lowest observed for the period.

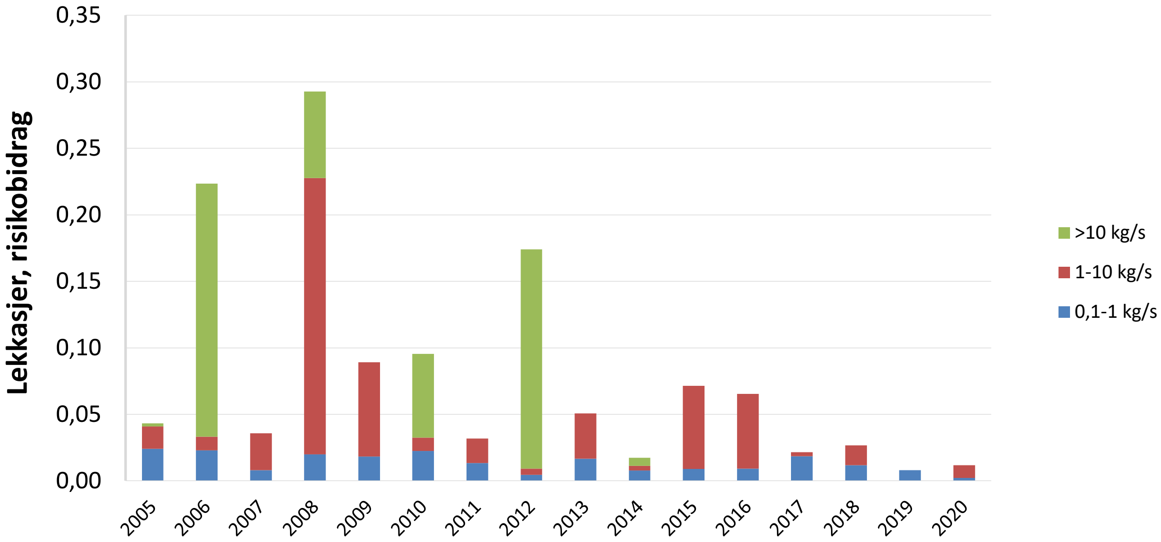

Figure 5.4 Hydrocarbon leaks exceeding 0.1 kg/s, 2005-20, weighted by risk potential

Figure 5.5 shows the trend for leaks above 0.1 kg/s, normalised against working hours for production facilities. The figure shows that leaks per million working hours in 2020 were within the prediction range. This change is therefore not statistically significant in relation to the 2010-19 average. Leaks have been normalised in the main report against both working hours and facilities.

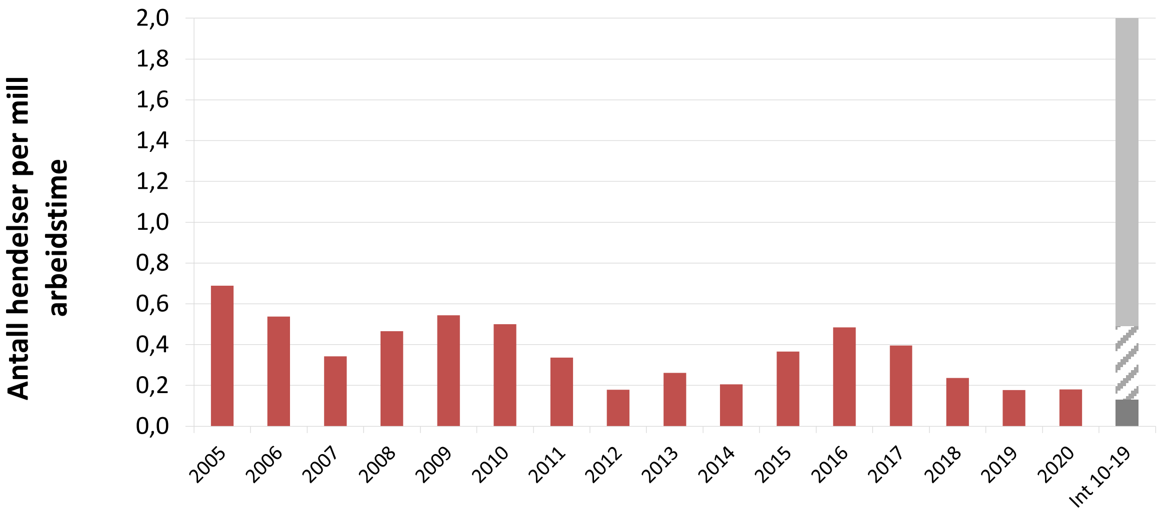

Figure 5.5 Trend for leaks, normalised against working hours

5.2.2 Loss of well control, blowout potential, well integrity

Figure 5.6 shows well control incidents broken down between exploration and production drilling, normalised per 100 wells drilled.

Ten well control incidents occurred in 2020 – six in production drilling and four in exploration drilling. All were in the lowest risk category. Figure 5.6 shows the proportion of well-control incidents per 100 wells drilled. The 2020 number is the lowest observed during the period. In general, the number of well-control incidents per well drilled has been higher and has shown greater annual variation for exploration drilling than for production drilling. While both 2016 and 2017 were exceptions, with zero incidents for exploration drilling, the frequency of well control incidents in 2018-20 was again highest for exploration drilling.

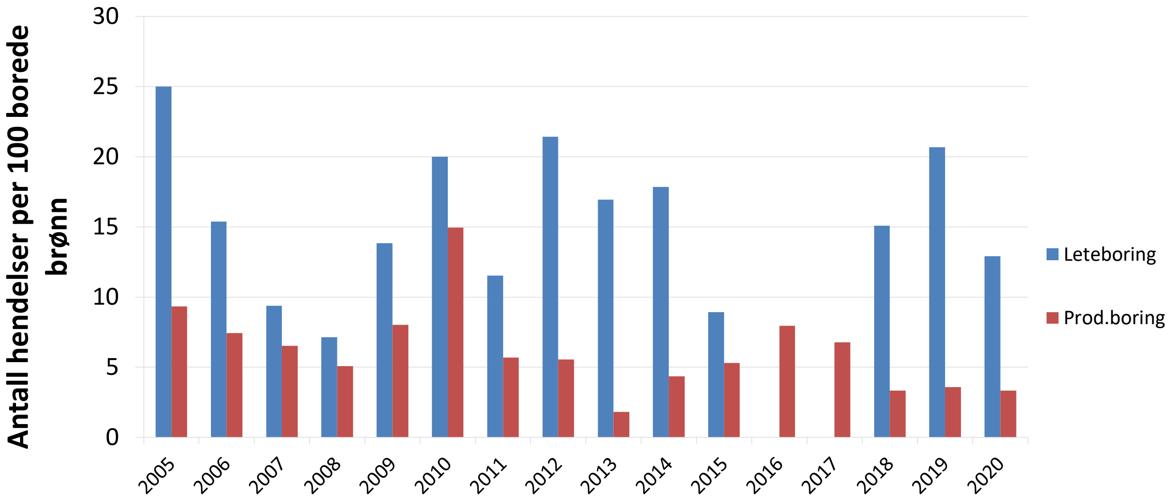

Figure 5.6 Well incidents per 100 wells drilled for exploration and production drilling

Figure 5.7 presents the trend in weighted risk of loss of life normalised against working hours for exploration and production drilling combined. The figure shows that the risk associated with well control incidents on the NCS was relatively low in 2017-20.

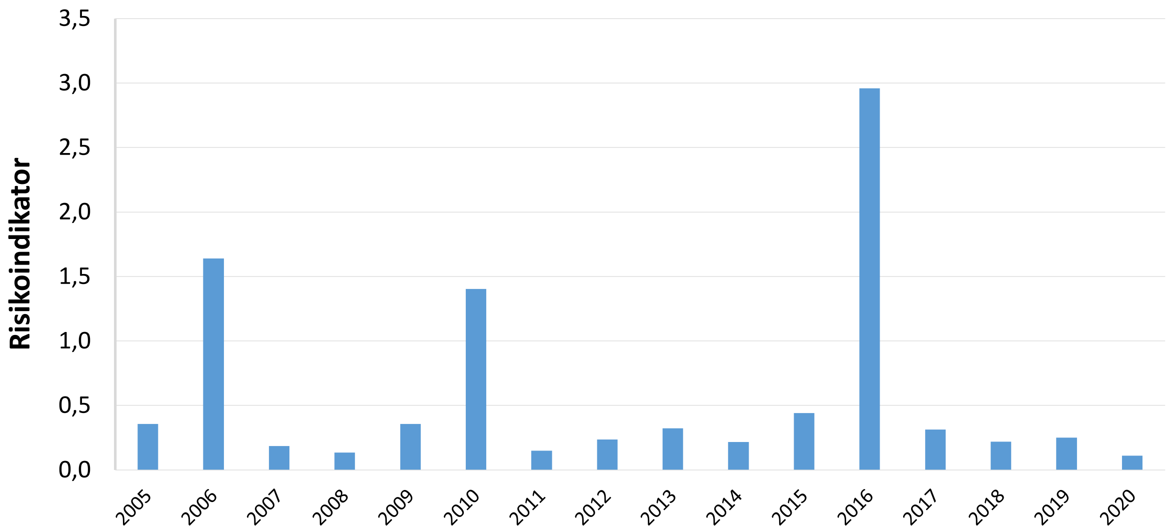

Figure 5.7 Risk indicators for well-control incidents in exploration and production drilling, 2005-20

The Norwegian Oil and Gas Association has continued its work on well integrity issues through the Well Integrity Forum (WIF), a sub-group of the Drilling Managers Forum. This joint industry project involves operator companies on the NCS with production wells on stream.

Norwegian Oil and Gas guidelines no 117 also cover recommendations on training and documents for well handovers between different departments in a company, including well-barrier diagrams and criteria for categorising wells.

Table 5.1 presents the criteria for categorising wells by well integrity in accordance with guidelines no 117.

Table 5.1 Criteria for categorising wells by well integrity

Category	Principle
Red	Failure of one barrier and the secondary is degraded/uncontrolled, or leak to the surface.
Orange	Failure of one barrier and the secondary is intact, or single failure which may cause leakage at the surface.
Yellow	One barrier degraded, secondary intact.
Green	Well undamaged – no or minimal nonconformity.

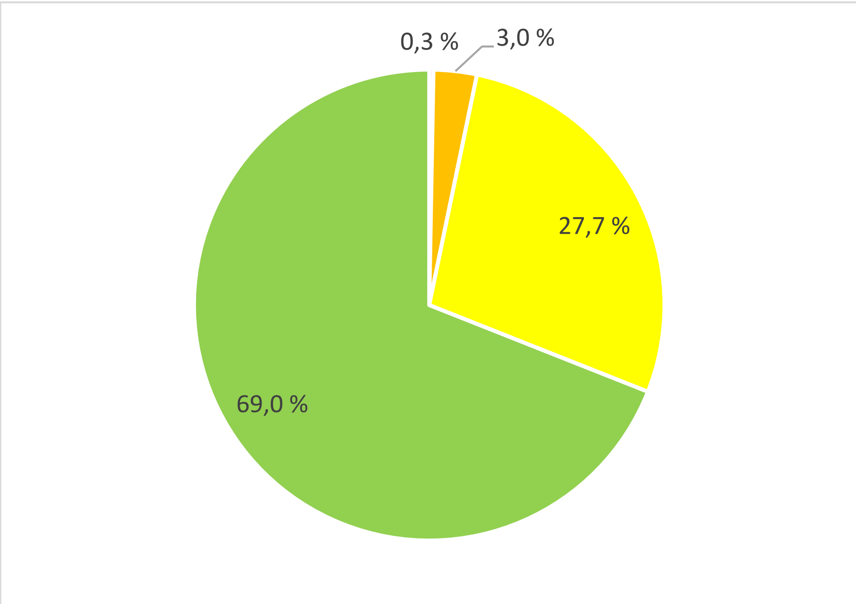

Figure 5.8 Well categories

Figure 5.8 presents an overview of well categories by percentage share of 2 087 wells in all.

This categorisation shows that about 30 per cent of the wells included in the mapping have some degree of integrity loss. Wells in the red and orange categories have reduced quality with regard to the two-barrier requirement. Six wells (0.3 per cent) are recorded in the red category and 62 (three per cent) in the orange. Five temporarily plugged wells are included in the red category. All types of wells are found in the orange category. The quality of wells in the yellow category is reduced in relation to the two-barrier requirement, but various compensatory measures adopted by the companies mean they are deemed to be in compliance with it. This category includes 579 wells (27.8 per cent).

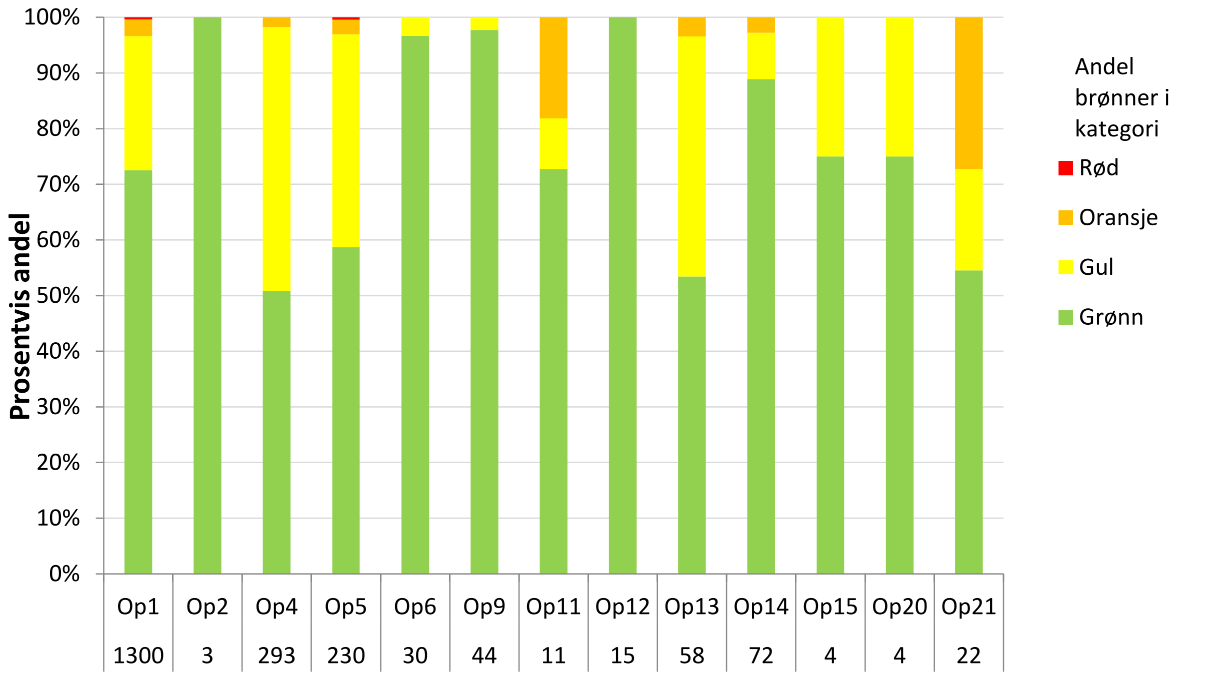

Figure 5.9 Well categorisation by operator, 2020[1]

Figure 5.9 presents the 13 operators and their wells broken down by the red, orange, yellow and green integrity categories. Two operators (1 and 5) have wells in the red category. Seven of the 13 have more than 75 per cent of their wells in the green category, and two of these report all their wells in the green category.

5.2.3 Leaks/damage to risers, pipelines and subsea facilities

No serious leaks were reported in 2020 from risers or from pipelines within the safety zones for surface facilities. One leak/spill of methanol was reported from a manned facility where the cause was related to a failure to blind pipes. Two other reported leaks came from a pipeline transporting water and from pressure-testing of a riser with water.

Two small oil leaks were reported in 2020 from subsea production facilities, one of which related to a subsea loading system and the other to a well intervention operation. As in earlier years, individual leaks of chemicals such as hydraulic/barrier/control fluids and the like continued to occur. Six such leaks were reported to the PSA, and were a mix of fractures in small pipe sections/control cables and degraded/destroyed seals.

[1] The number of wells included for each operator is specified under Op1, Op2 and so forth.

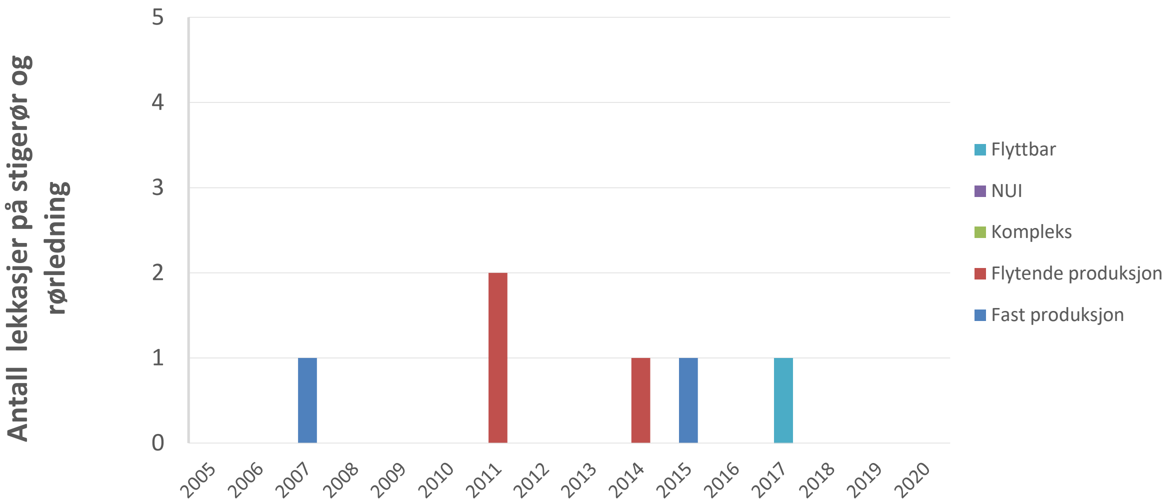

Figure 5.10 Leaks from risers and pipelines in the safety zone, 2005-20

Two cases of serious damage to flexible risers and associated auxiliary equipment were reported in 2020. Flexible risers have been and remain an important contributor to risk. The PSA has followed up this subject over a number of years and conducted a number of supervisory activities directed at these risers in 2020. Based on this follow-up, the seriousness of two flexible-riser incidents in 2019 has been upgraded in the statistics. The raised the number of serious incidents in this year to five. Figure 5.11 presents serious damage to risers and pipelines in 2005-20.

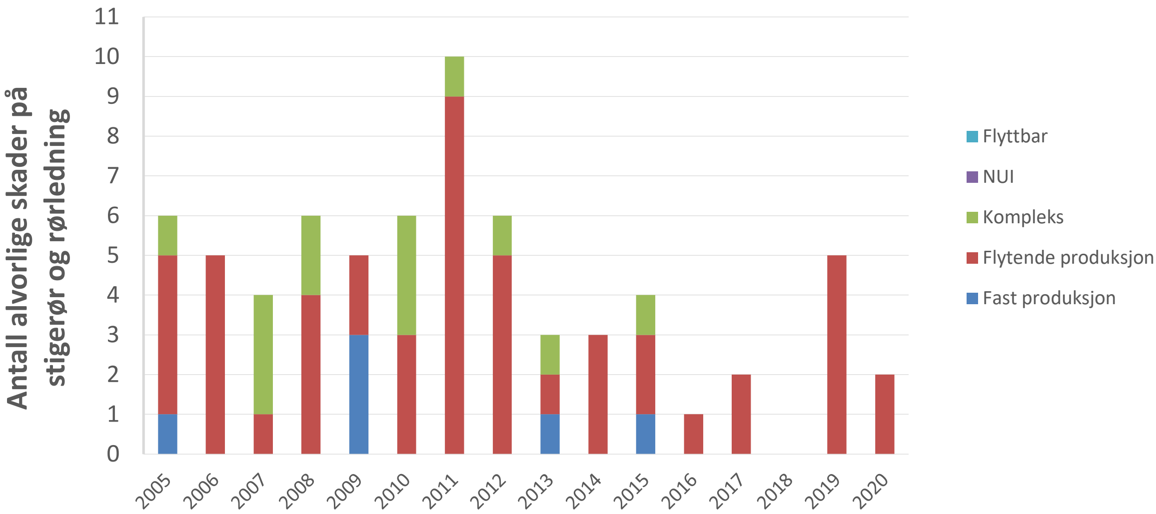

Figure 5.11 Major damage to risers and pipelines in the safety zone, 2005-20

5.2.4 Ships on a collision course, structural damage

Since just a handful of production facilities, and only slightly more mobile facilities, have not been monitored by a vessel traffic management centre since 2010, some changes have been made to normalisation (previously by monitoring days, now by facility-years) and weighting for DSHA 5. For further details, see the methodology report (PSA, 2021).

Cases of ships on a collision course have declined substantially in recent years. A total of six such instances were recorded in 2020.

Collisions between vessels related to petroleum operations and facilities on the NCS were at a high level in 1999 and 2000 (15 incidents in each year). Equinor, in particular, has done much work to reduce such incidents, and there have been about two-three annually in recent years. There were no collisions in 2020.

Serious accidents associated with structures and maritime systems are rare. Although Norway has experienced several very serious incidents, they are too few for gauging trends. Less severe incidents and damage have therefore been selected to measure changes in risk. It is also assumed that a relationship exists between the number of minor incidents and the most serious cases. See the methodology report.

The current regulations require flotels and production facilities to withstand the loss of two anchor lines without serious consequences. Losing more than one anchor line happens from time to time. Mobile drilling facilities are required to withstand the loss of one anchor line without undesirable consequences.

Structural damage and incidents included in the RNNP are classified to a great extent as fatigue damage, while a number of cases involve storm damage. Where cracking is concerned, only continuous structural cracks are included. No clear connection has been established between the age of a facility and the number of cracks. Figure 5.12 shows reported incidents and damage to structures and maritime systems in 2005-20 which satisfy the criteria for DSHA 8. A total of 11 incidents are included for 2020, which represents the highest reported number since 2012.

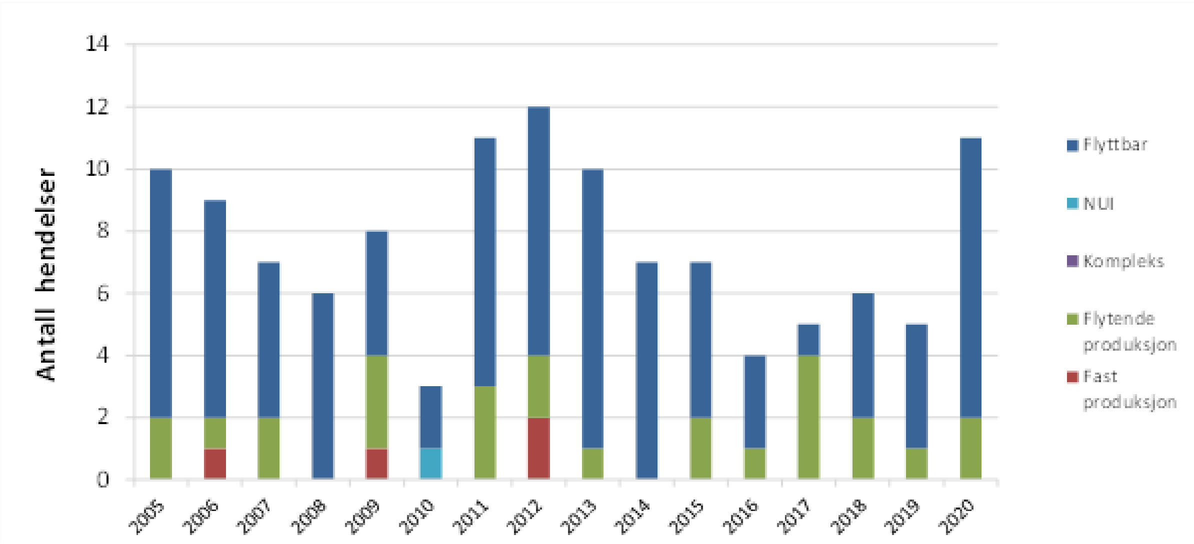

Figure 5.12 Reported incidents and damage events to structures and maritime systems satisfying the criteria for DSHA 8

5.3 Total indicator for major accidents

The total indicator is calculated on the basis of the frequency of incidents and their potential to cause loss of life should they develop into a real incident. It is emphasised that this indicator serves solely as a supplement to the individual indicators, and expresses the trend for risk factors related to major accidents. In other words, the indicator expresses the effects of risk management.

Contributions to the total indicator from observations of the individual DSHAs are weighted in relation to their potential for loss of life, and the indicator will therefore vary considerably in line with the potential of individual incidents. These weights were changed in 2020 to give a better reflection of current knowledge. More details of them can be found in the methodology report (PSA, 2021). The weights remain fixed for various types of incidents and facilities. Individual assessments are made for the largest incidents in order to determine a realistic weighting on the basis of the actual conditions on the facility and in the incident. No particularly large incidents occurred in 2020.

This indicator features large annual variations, primarily because of particularly serious incidents. These big variations are reduced when looking at the three-year rolling average, which clarifies the long-term trend. Working hours are used for normalising against the activity level. The level of the normalised value is set at 100 in 2005, as is the value for the three-year rolling average.

Figure 5.13 presents the total indicator for production and mobile facilities. The value in 2020 was higher than the year before even though the number of incidents was lower. This is mainly because of the increase in structure-related incidents. The underlying trend, illustrated with the aid of the three-year rolling average, is positive over time with a flattening out in the past two years.

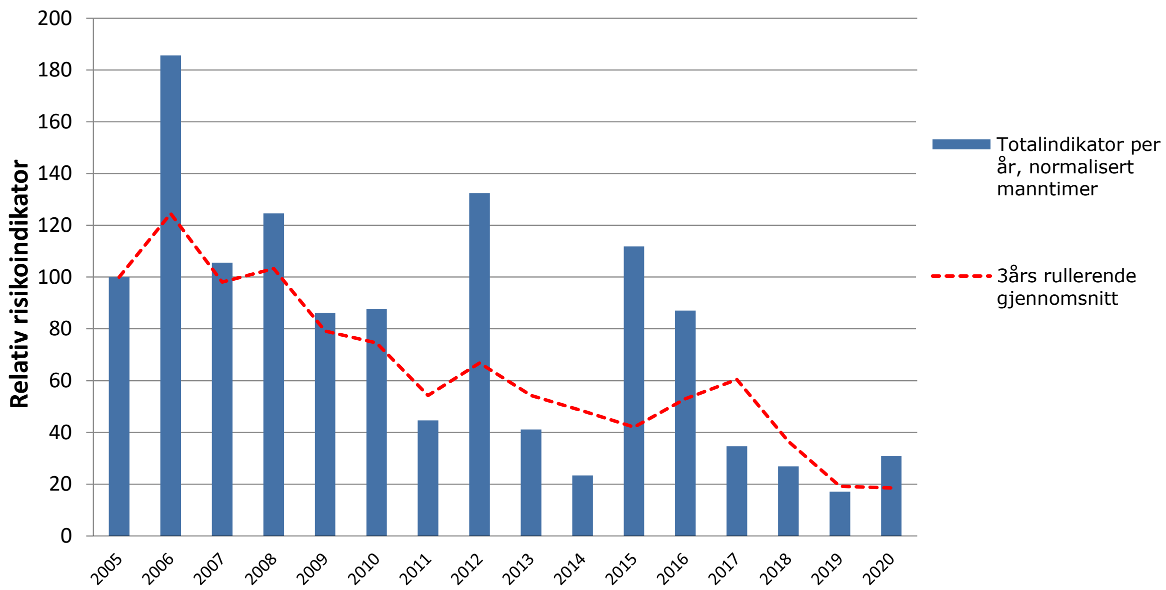

Figure 5.13 Total indicator for major accidents per annum, normalised against working hours (reference value 100 in 2005 for both total indicator and three-year rolling average)

The three-year rolling average shows a clearly positive trend since 2002. This can be interpreted to mean that the players got better over the period at managing factors which affect major accident risk. The columns show large annual variations, which mainly reflect particularly serious incidents. This can also be taken as an indication that great attention must be devoted to factors which affect future risk, and that these must be actively managed.

Figures 5.14 and 5.15 present the total indicator for production and mobile facilities respectively.

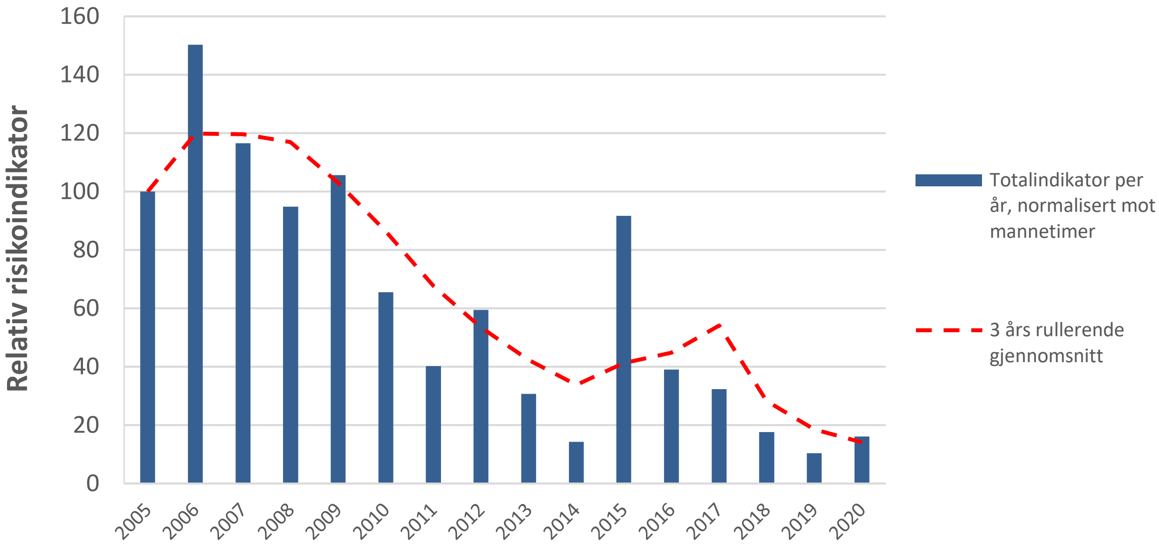

Figure 5.14 **Total indicator, major accidents, production facilities, normalised against working hours, compared with three-year rolling average (reference value 100 in 2005 for both total indicator and three-year rolling average**)

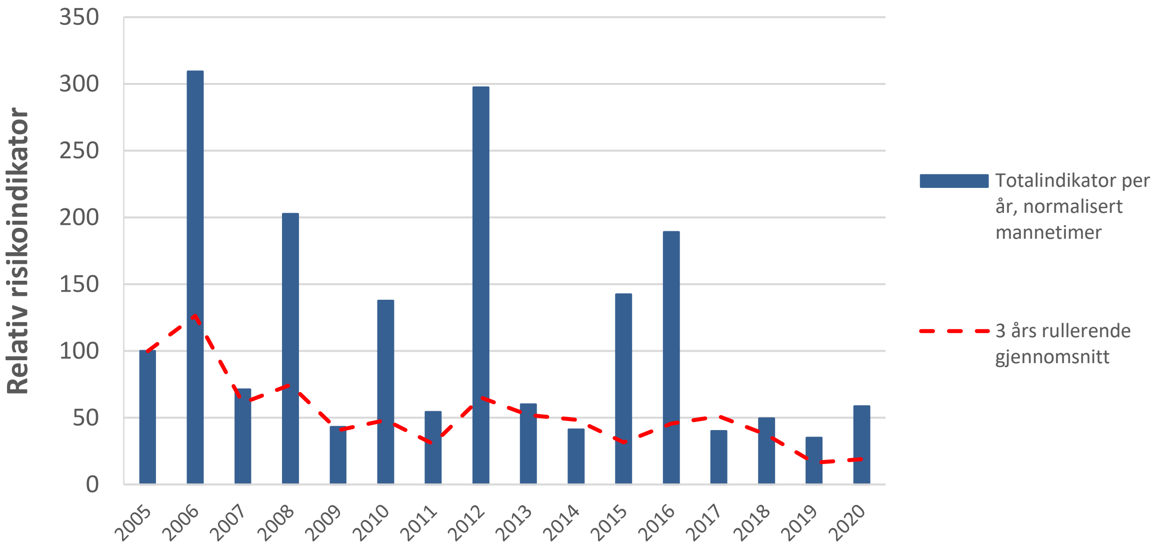

Figure 5.15 **Total indicator, major accidents, mobile facilities, normalised against working hours, compared with three-year rolling average (reference value 100 in 2005 for both total indicator and three-year rolling average**)

6. Status and trends – barriers against major accidents

Reporting and analysis of data on barriers have been maintained from previous years without significant adjustments. As before, the companies report data from routine periodic testing of selected barrier elements.

6.1 Barriers on production facilities and in process plants

The main emphasis is on barriers related to leaks on production facilities and in process plants, which include the following barrier functions:

- integrity of hydrocarbon production and process facilities (covered to a great extent by the DSHAs)
- prevent ignition
- reduce clouds/emissions
- prevent escalation
- prevent fatalities.

The various barriers comprise several interacting barrier elements. A leak must be detected, for example, before ignition sources are isolated and emergency shutdown (ESD) is initiated.

Figure 6.1 presents the proportion of failures for selected barrier elements related to production and process. Test data are based on reports from all production operators on the NCS. The associated industry norm for each barrier element is also shown.

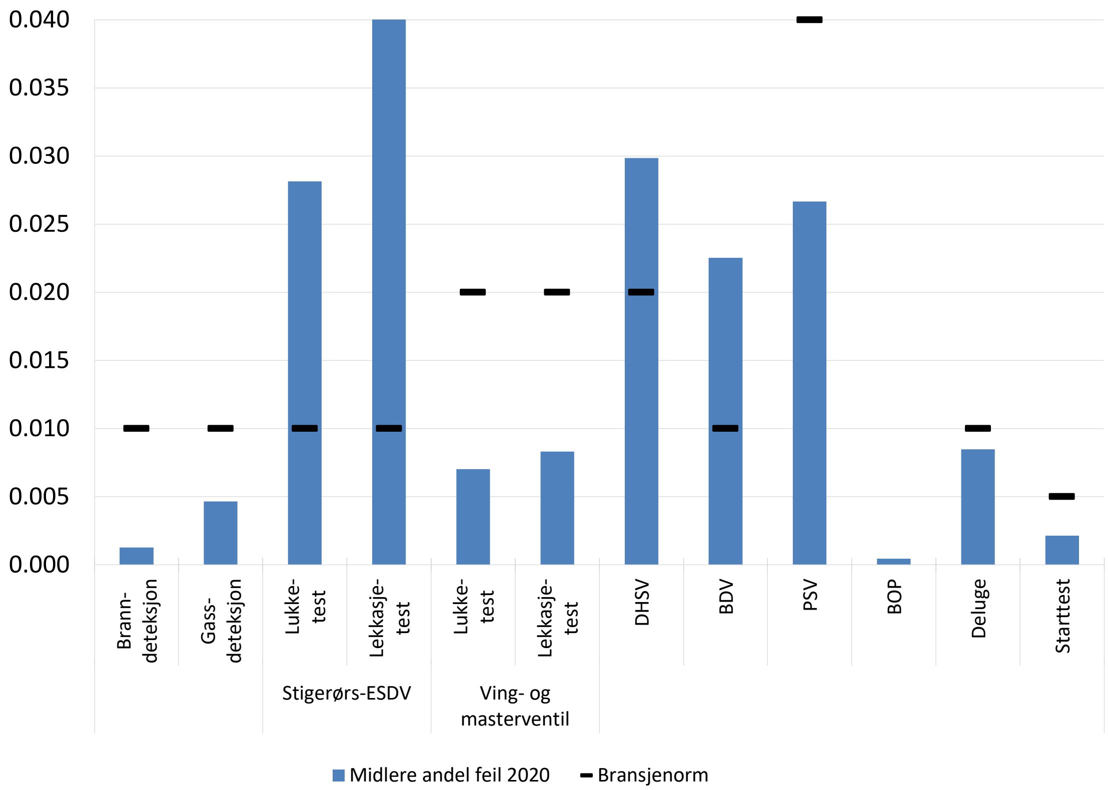

Figure 6.1 Mean percentage of failures for selected barrier elements in 2020

The main report shows both the mean percentage of failures (figure 6.1) – in other words, the percentage of failures for each facility individually averaged for all facilities – and the overall percentage of failures – in other words, the sum of all failures on all facilities which have reported divided by the sum of all tests for all facilities reporting. All facilities make the same contribution to the mean percentage of failures, regardless of how many tests they have conducted.

The data show large variations in average levels for each operator company and for several of the barrier elements. Even greater variations appear when considering each facility, as has been done for all barrier elements in the main report. Figure 6.2 presents an example of such a comparison for gas detection (all gas detector types). Each facility is assigned a letter, and the figure shows the percentage of failures in 2020, the average percentage of failures in 2005-20 and total tests carried out in 2020 (as text on the X axis together with the facility letter).

The industry norm for gas detection is 0.01. Figure 6.2 shows that nine facilities were above the norm for proportion of failures in 2020, while eight were above the norm when the average for 2005-20 is considered.

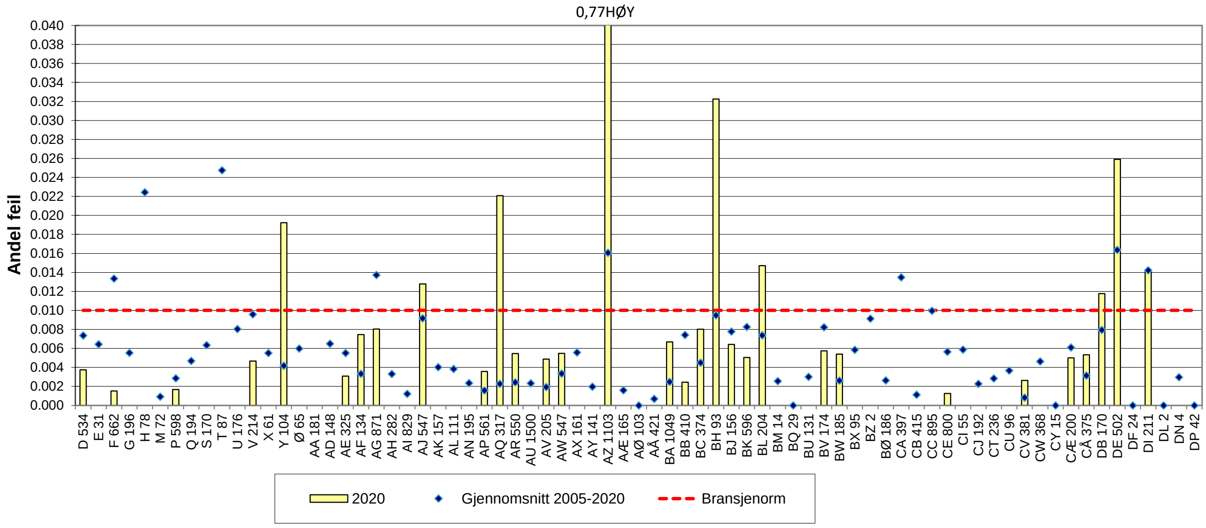

Figure 6.2 Percentage of gas detection failures

Data for most barriers on production facilities have now been collected over 19 years, and the results show large differences in level between facilities. Figures 6.3 and 6.4 compare mean percentage failures for three-year rolling averages from 2011 to 2020.

Figure 6.3 shows that fire detection, gas detection and start-up tests for fire pumps are consistently low and below the respective industry norms. The closure test for riser emergency shutdown valves (ESDV) shows a decline from the start of the period until 2015. But it has a rising trend from then until 2020, when it was well above the industry norm of 0.01. The BDV shows a slightly declining trend from 2018 to 2020, but was above the industry norm of 0.01 in 2020. The riser ESDV leak test and deluge show a rise in the middle of the period and a fall since 2015. From 2016 to 2018, deluge was again above the industry norm of 0.01 for the three-year rolling average. In 2020, the riser ESDV leak test was far above the industry norm of 0.01 for the three-year rolling average.

Figure 6.4 shows that the DHSV has a rising trend from 2012 to 2017 and flattens out in 2018 before declining slightly in 2019-20. It has been above the industry norm of 0.02 since 2013. Other barriers remain below applicable industry norms. Generally speaking, figures 6.3 and 6.4 show that the trend for most barrier elements is flattening out or rising. The riser ESDV leak test and the pressure safety valve (PSV) are the barrier elements showing the greatest change and a rising trend for proportion of failures.

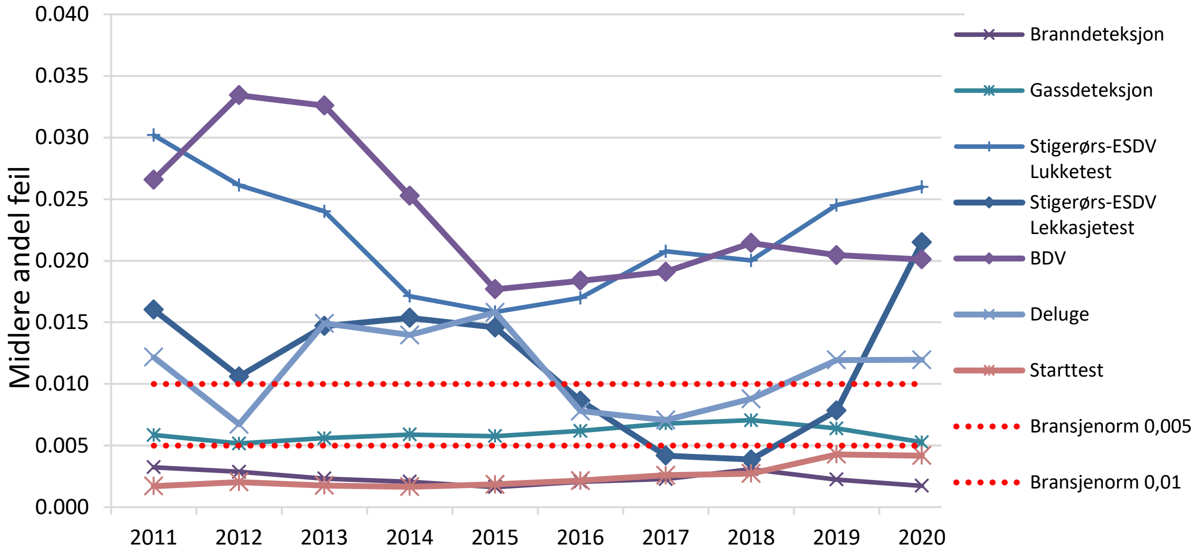

Figure 6.3 Mean percentage failures as a three-year rolling average

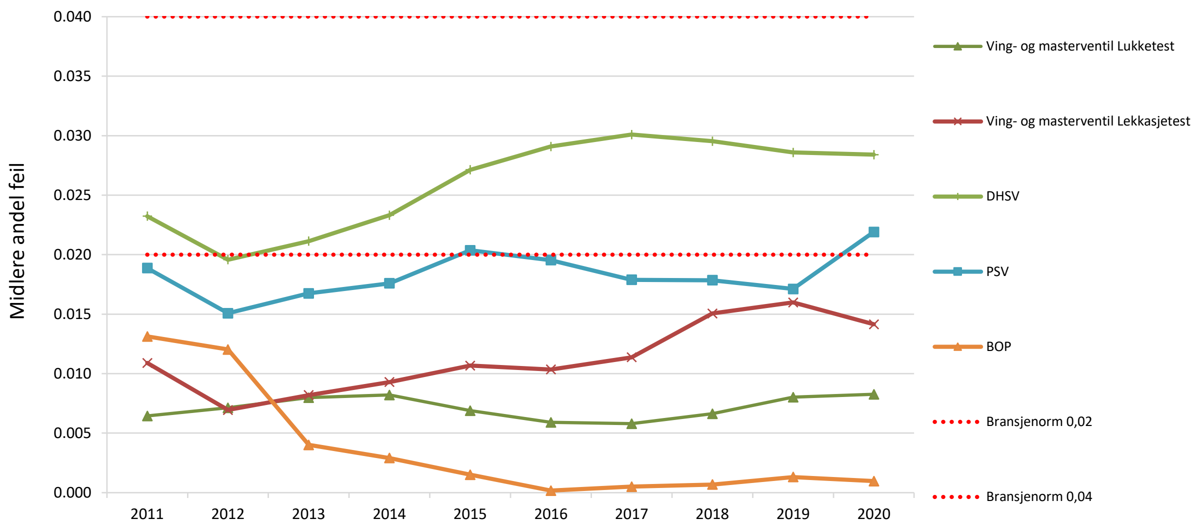

Figure 6.4 Mean percentage failures as a three-year rolling average

Table 6.1 presents how many facilities have conducted tests for each barrier element, the total number of tests, the average number of tests for facilities which have tested, the overall percentage of failures and the mean percentage of failures for 2020 and for 2005-20. This can then be compared with the industry norm for safety-critical systems. Figures in bold indicate that the percentage of failures exceeds the industry norm.

Overall, the table shows that many barrier elements are below the industry norm for availability. Mean percentage failures for 2020 and mean percentage failures in 2005-20 for riser ESDV closure and leak tests, DHSV and BDV were above the industry norm. Where deluge is concerned, mean percentage failures for 2005-20 were above the industry norm.

Table 6.1 General calculations and comparison with industry norms for barrier elements

Barrier elements	*Facilities conducting tests in 2020*	*Average no of tests for facilities testing in 2020*	*Facilities with failures above industry norm in 2020 (average 2005-20 in brackets)*[2]	*Mean percentage failures in 2020*	*Mean percentage failures in 2005-20*	*Industry norm for availability*
Fire detection	71	545	4 (2)	0.001	0.003	0.010
Gas detection	73	300	9 (9)	0.005	0.008	0.010
Shutdown:						
· Riser ESDV	66	19	17 (33)	**0.031**	**0.019**	0.010
closure test	65	12	10 (28)	**0.028**	**0.021**	0.010
leak test	66	7	10 (22)	**0.043**	**0.015**	0.010
· Wing and master (Xmas tree)	77	217	9 (8)	0.007	0.010	0.020
closure test	74	101	7 (3)	0.007	0.007	0.020
leak test	77	120	10 (11)	0.008	0.012	0.020
· DHSV	76	75	32 (38)	**0.030**	**0.025**	0.020
BDV	64	49	28 (46)	**0.022**	**0.022**	0.010
PSV	72	116	16 (6)	0.027	0.023	0.040
Isolation with BOP	22	118	1	**0.0004**	0.014	-
Active fire protection:						
· deluge valve	72	27	16 (24)	0.008	**0.011**	0.010
· start-up test	61	89	8 (12)	0.002	0.003	0.005

6.2 Barriers associated with maritime systems

Data were collected in 2020 for the following maritime barriers on mobile facilities:

- watertight doors
- valves in the ballast system
- deck height (air gap) for jack-up facilities
- GM and KG margin values for floaters, with KG margin values collected since 2015.

Data collection was carried out for both production and mobile facilities. Considerable variations exist in testing per facility, from daily to twice a year.

6.3 Maintenance management

Inadequate or lack of maintenance has proved a contributory cause of major accidents. The major accident potential means that safety work in general and maintenance of safety-critical equipment in particular receive great emphasis in the petroleum industry.

The aims of such maintenance management include identifying critical functions and ensuring that safety-critical barriers function when required.

Data have been acquired from players since 2010 in order to monitor trends for selected indicators. Securing an overview of the present position and trends over time makes it easier for the industry and the government to set priorities for future work.

[2] The average is from 2007 for *closure* and *leak tests* with riser ESDVs and wing and master valves, and from 2005 with PSVs and BDVs.

Each player is responsible for complying with the regulations and ensuring systematic HSE work in order to reduce the risk of undesirable incidents and major accidents.

6.3.1 Maintenance management on fixed facilities

The main report contains more graphs presenting maintenance management figures from the operators than are reproduced here.

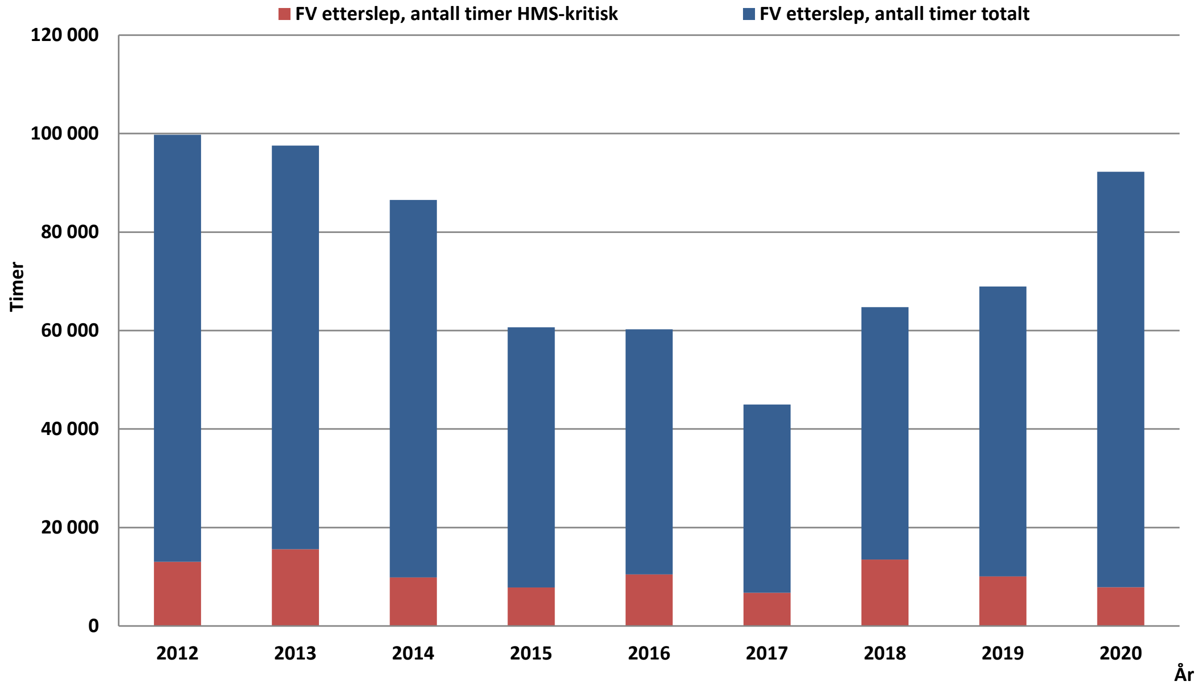

Figure 6.5 Total backlog in PM per annum in 2012-20 for fixed facilities

Figure 6.5 shows that the total backlog in preventive maintenance for 2020 was higher than reported levels in recent years. The backlog in HSE-critical preventive maintenance had been reduced somewhat compared with 2018 and 2019.

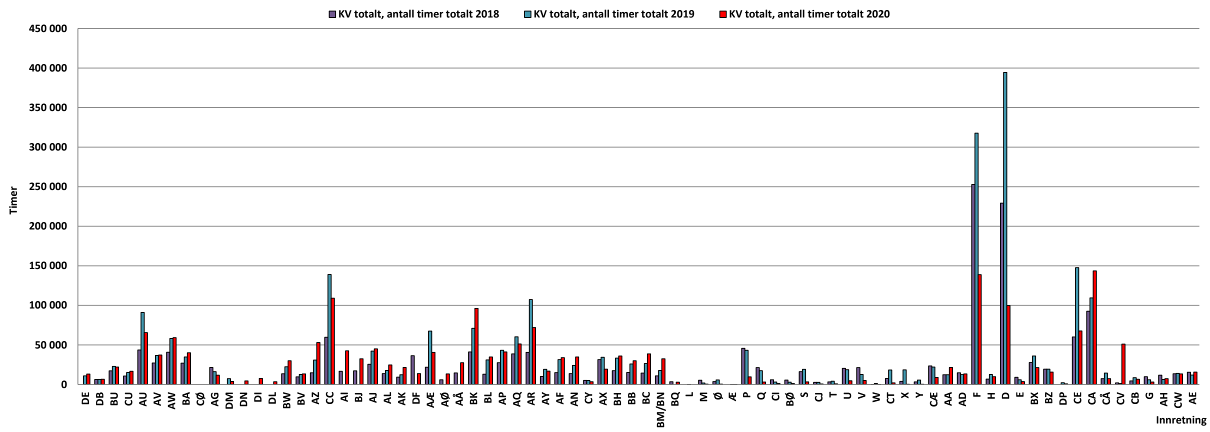

Figure 6.6 Total CM at 31 December 2020 for fixed facilities. Data for 2018 and 2019 also shown

Figure 6.6 shows that hours of corrective maintenance yet to be carried out at 31 December 2020 were substantial for some facilities. While some facilities had reduced outstanding hours, most had a stable figure.

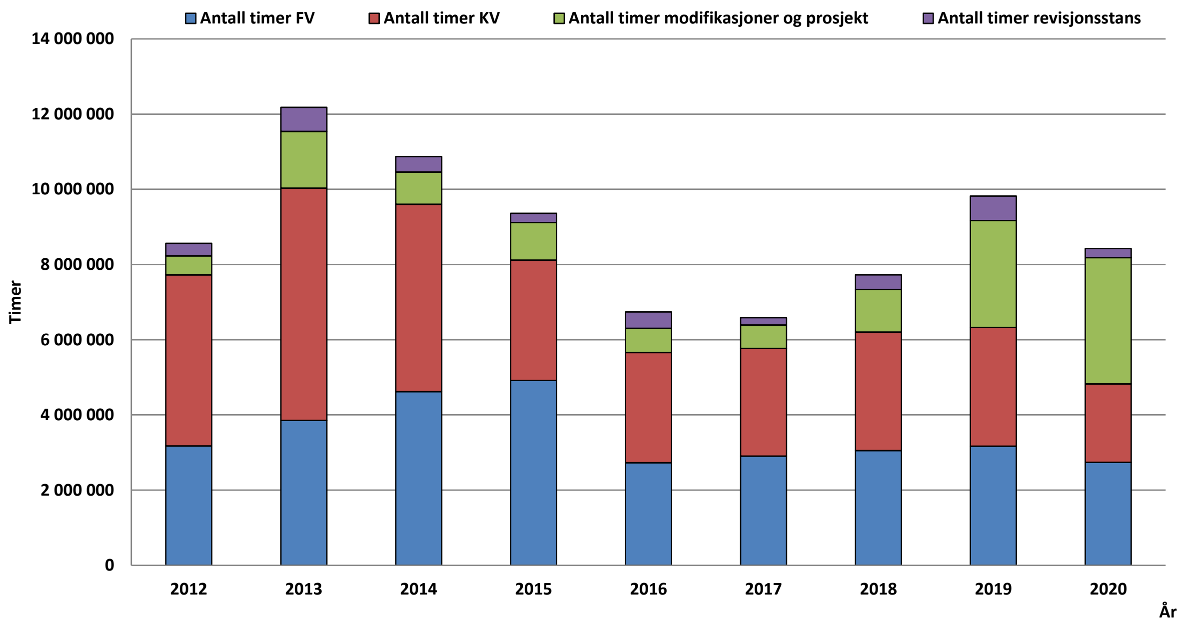

Figure 6.7 Total hours of maintenance, modifications and turnarounds on fixed facilities in 2012-20

Figure 6.7 presents total hours devoted to maintenance, modifications and turnarounds on fixed facilities in 2012-20. The figure is particularly intended to show the *distribution* of these activities. Hours devoted to preventive and corrective maintenance in 2020 were slightly lower than the year before, and the lowest level reported in 2012-20. Hours spent on modifications and projects had also increased.

Where maintenance on fixed facilities is concerned, the following can be observed.

- Some of the facilities have failed to classify part of their tagged equipment
- Large variations exist in the proportion of HSE-critical equipment. This is small on some facilities, despite the operators using virtually the same classification method.
- Few hours of backlog exist for preventive maintenance, but several facilities have not done HSE-critical preventive maintenance in accordance with their own deadlines.
- The total backlog in preventive maintenance was higher in 2020 than had been reported in recent years, while the backlog in HSE-critical preventive maintenance was somewhat smaller than in 2018 and 2019.
- Hours of corrective maintenance still to be carried out were substantial on some facilities at 31 December 2020. Some facilities had reduced outstanding hours, but most had a stable figure.
- Viewed overall, hours of corrective maintenance yet to be done were substantial at 31 December 2020. But the figures were nevertheless down from the year before.
- Hours of total outstanding corrective maintenance increased substantially in 2020 compared with the year before. Total outstanding HSE-critical corrective maintenance was stable.
- Hours of preventive and corrective maintenance conducted in 2020 were down slightly from the year before and are the lowest reported figure for 2012-20. It can also be seen that hours devoted to modifications and projects have increased.
- A large variation exists in the percentage distribution of preventive and corrective maintenance performed per player.

These observations must be viewed in relation to the regulatory requirements, notably the following.

- Plant, systems and equipment must be tagged and classified so as to facilitate safe operation and prudent maintenance, including maintaining the performance of the barriers.
- The activity level on the facility must take account of the status of maintenance performance. Status is this context includes the backlog of preventive maintenance and the outstanding corrective maintenance.
- The significance of unperformed maintenance must be assessed both individually and in combination. The assessment is crucial for determining the extent to which unperformed maintenance entails increased risk
- Backlogs in the HSE-critical preventive maintenance may contribute to increased uncertainty with regard to technical condition, and hence increased risk
- Corrective maintenance of HSE-critical equipment should not exceed the defined deadlines, since the HSE-critical equipment is intended to inhibit or restrict the DSHAs.

6.3.2 Maintenance management on mobile facilities

Figure 6.8 presents tagged equipment on mobile facilities in 2018-20.

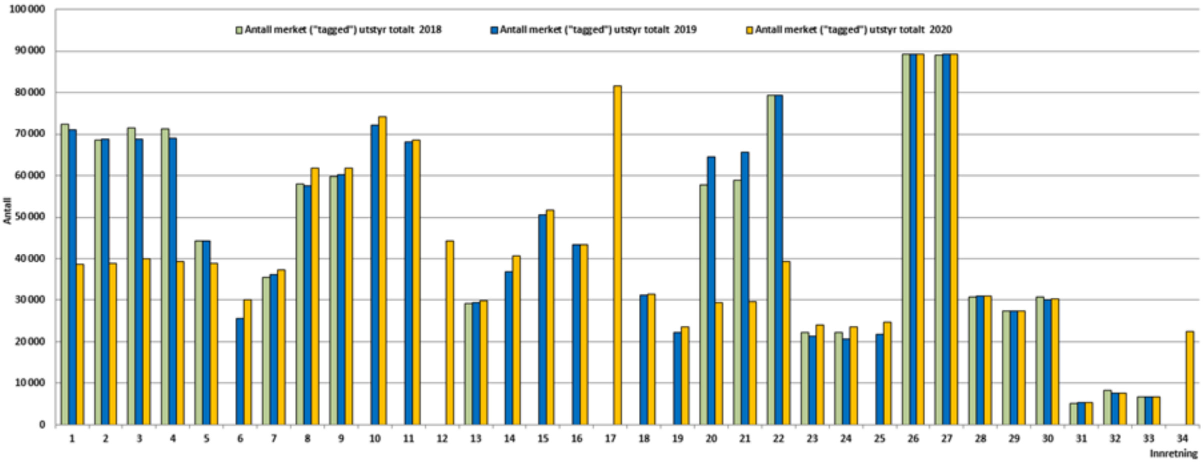

Figure 6.8 Tagged equipment on mobile facilities in 2018-20

Some facilities can be seen to have reported a substantially lower amount of tagged equipment in 2020 than the year before.

Figure 6.9 presents the backlog in preventive maintenance in 2020.

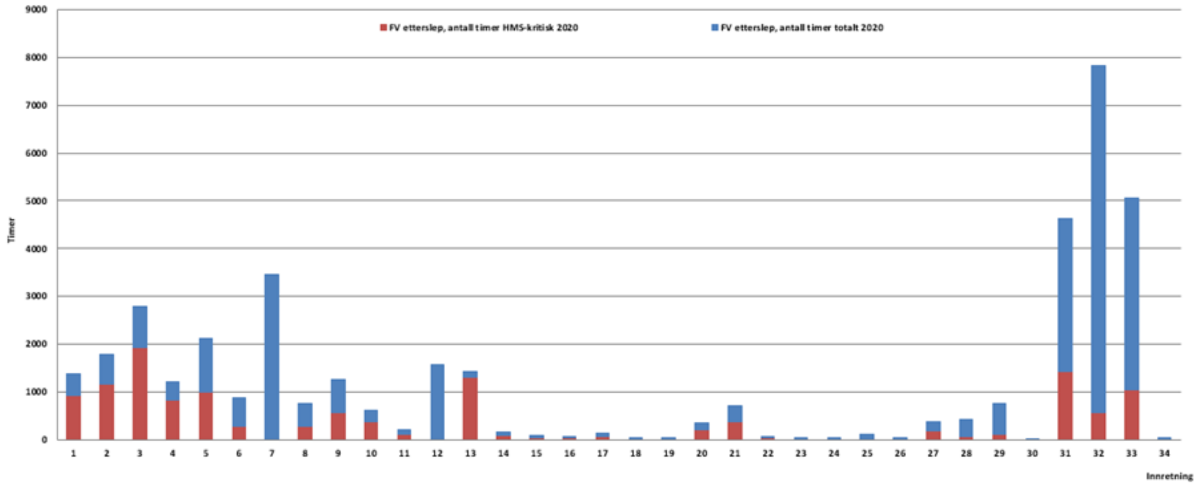

Figure 6.9 Backlog in PM for mobile facilities in 2020.

Large variations exist in the backlog of preventive maintenance for mobile facilities. This accords with the PSA’s observations in recent years. Several facilities have not performed HSE-critical preventive maintenance in accordance with their own deadlines. This may help to increase uncertainty over technical condition and thereby enhance risk.

Maintenance is very important for maintaining critical functions and for ensuring that HSE-critical equipment functions when required.

Figure 6.10 presents *outstanding corrective maintenance* in 2020.

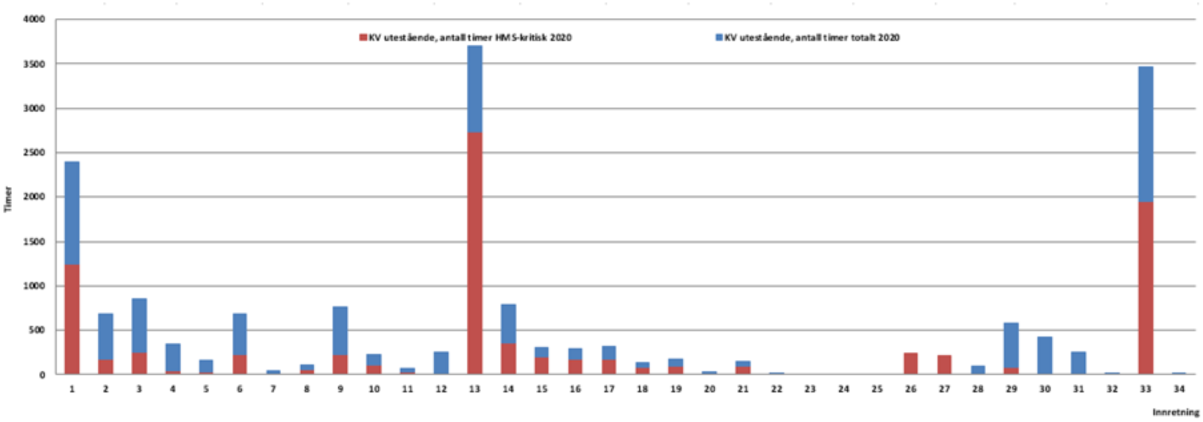

Figure 6.10 Outstanding CM for mobile facilities in 2020.

Large variations exist in outstanding corrective maintenance for mobile facilities. This accords with the PSA’s observations in recent years. However, the hours involved are relatively limited. Several facilities have not done HSE-critical corrective maintenance in accordance with their own deadlines.

Maintenance of this type of equipment should not fail to meet the specified deadlines, since HSE-critical equipment is intended to prevent or restrict DSHAs.

The PSA has emphasised on a number of occasions how important it is that operators assess the significance of outstanding corrective maintenance, both for individual items and collectively. Such assessments are crucial in determining how far the outstanding maintenance contributes to increased risk.

The following can be observed.

- Considerable variation exists in the degree of tagging and classification of systems and equipment on the facilities.
- Generally speaking, newer facilities have more tagged and classified equipment than older ones.
- Some facilities have reported a substantially smaller amount of tagged equipment in 2020 than the year before.
- Considerable variation exists in the proportion of HSE-critical equipment. Some facilities have a small proportion.
- Variations exist in the backlog of preventive maintenance on mobile facilities. This accords with the PSA’s observations in recent years.
- Several facilities have not done HSE-critical preventive maintenance in accordance with their own deadlines.
- Variations exist in outstanding corrective maintenance on mobile facilities. This accords with the PSA’s observations in recent years. However, the hours involved a relatively limited.
- Several facilities have not done HSE-critical corrective maintenance in accordance with their own deadlines.

- Considerable variation exists in the percentage distribution between preventive and corrective maintenance done per player.

These observations must be viewed in relation to the regulatory requirements, notably the following.

- Plant, systems and equipment must be tagged and classified so as to facilitate safe operation and prudent maintenance, including maintaining the performance of the barriers.
- The activity level on the facility must take account of the status of maintenance performance. Status is this context includes the backlog of preventive maintenance and the outstanding corrective maintenance.
- The significance of unperformed maintenance must be assessed both individually and in combination. The assessment is crucial for determining the extent to which unperformed maintenance entails increased risk
- Backlogs in the HSE-critical preventive maintenance may contribute to increased uncertainty with regard to technical condition, and hence increased risk
- Corrective maintenance of HSE-critical equipment should not exceed the defined deadlines, since the HSE-critical equipment is intended to inhibit or restrict the DSHAs.

7. Work accidents involving fatalities and/or serious personal injury

No fatalities occurred in the PSA's area of authority on the NCS in 2020. In that year, the PSA registered 191 personal injuries on facilities involved in petroleum activities on the NCS which fulfil the criteria of fatality, absence into the next shift or medical treatment. In 2019, 234 personal injuries were reported.

In addition, 12 injuries classified as off-work injuries and 14 first-aid injuries were reported in 2020. By comparison, there were 35 off-work and 31 first-aid injuries the year before. First-aid and off-work injuries are not included in figures or tables.

The PSA has observed a reduction in injuries reported on NAV forms in recent years, and this trend continued in 2020. Forty per cent of the injuries were not reported to the PSA on NAV forms in that year. These injuries have therefore been recorded on the basis of information received when quality-assuring the data. Injuries not reported on NAV forms include three classified as serious. The injuries concern both contractor and operator employees. In order to deal with the reporting failures, the PSA contacted certain of the operator companies and drilling contractors in February 2021 to make them aware that they had injuries in their records which the PSA lacked. That resulted in a number of NAV forms being reported in arrears, which helped to reduce the percentage of injuries without NAV forms in 2020 compared with earlier years. The PSA received copious injury reports for 18 per cent of the injuries not reported on NAV forms in 2020.

Production facilities had 139 personal injuries in 2020, compared with 182 in 2019. The long-term trend for the injury frequency has been positive since 2010, when the overall figure was 7.3 injuries per million working hours. It was five per million working hours in 2020, down by 0.4 from the year before.

Fifty-two personal injuries were reported on mobile facilities in both 2019 and 2020. The total injury frequency fell from 4.4 per million working hours in 2019 to 3.9 in 2020. As with the production facilities, the long-term trend for the mobile facilities has been positive. The frequency declined from 5.8 in 2010 to 3.9 in 2020.

7.1.1 Serious personal injuries

Serious personal injuries are defined in the guidelines to section 31 of the management regulations. This definition provides the basis for classifying serious personal injuries.

Figure 7.1 shows the frequency of serious personal injuries on production facilities and mobile facilities combined. A total of 25 serious personal injuries were reported in 2020, compared with 33 in 2019.

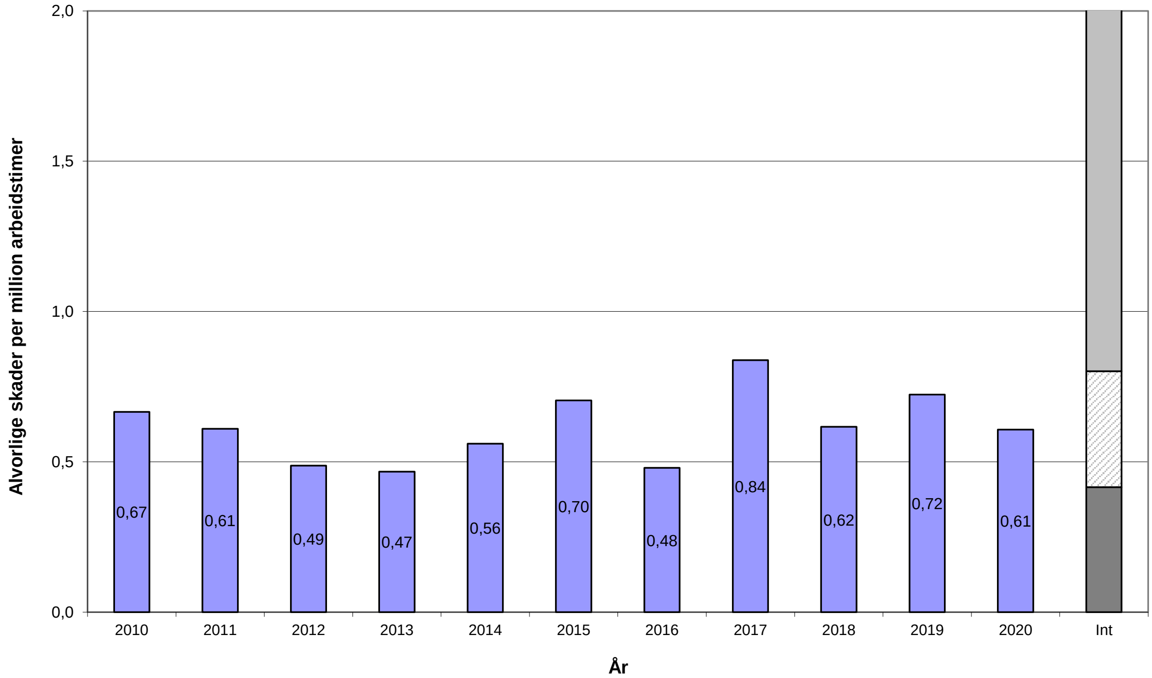

Figure 7.1 Serious personal injuries per million working hours – NCS

A downward trend prevailed in 2010-13. Developments have been more varied since 2014, with the serious injury frequency per million working hours ranging from 0.5 in 2016 to 0.8 in 2017. It declined from 0.7 in 2019 to 0.6 in 2020, when it was within the expected level based on the 10 preceding years.

The activity level on the NCS declined last year by 4.4 million working hours, from 45.6 million to 41.1 million.

7.1.2 Serious personal injuries on production facilities

Figure 7.2 presents the frequency of serious personal injuries per million working hours on production facilities. A downward trend prevailed from 2010 to 2013, when the frequency was at its lowest point. It varied from year to year in 2014-17, but always at a higher level than in 2013. A small rise occurred in 2018 to 2020. The frequency of serious injuries per million working hours rose from 0.7 in 2019 to 0.8 in 2020, when it was within the expected level based on the 10 preceding years.

Production facilities recorded 21 serious injuries in 2020, compared with 23 in 2019. Hours worked declined by 6,0 million, from 33.8 million in 2019 to 27.8 million in 2020.

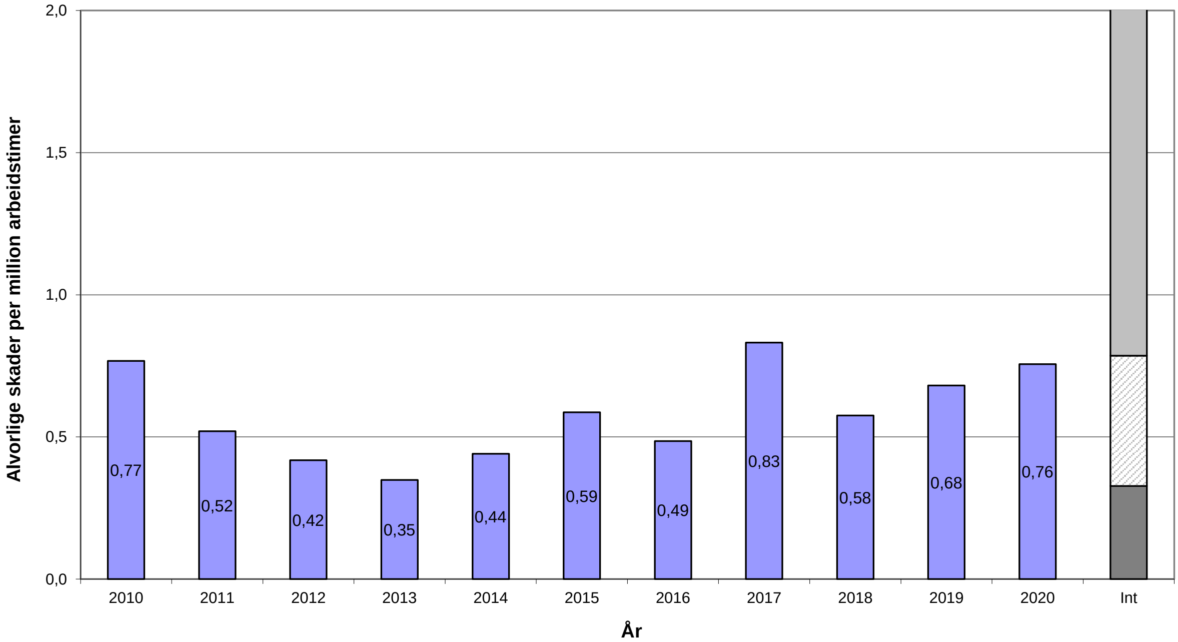

Figure 7.2 Serious personal injuries on production facilities per million working hours

7.1.1 Serious personal injuries on mobile facilities

Figure 7.3 presents the frequency of serious personal injuries per million working hours on mobile facilities. In 2020, this was at its lowest level for the period at 0.3 serious personal injuries per million working hours. The injury frequency was at the lowest level of the expected value based on the preceding 10 years. Between 2010 and 2019, the years 2010 and 2016 stand out as positive but the level has otherwise varied over the rest of the period.

Reported hours worked on the mobile facilities came to 13.4 million in 2020, compared with 11.8 million the year before. Four serious injuries were recorded in 2020 and 10 in 2019.

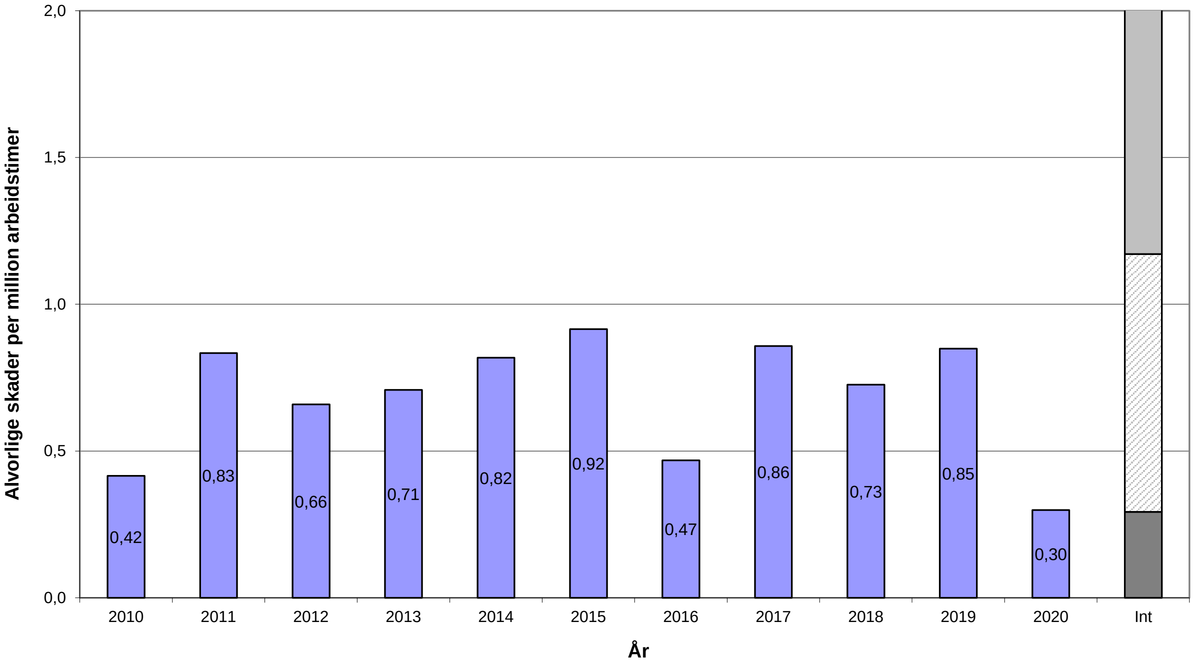

Figure 7.3 Serious personal injuries per million working hours, mobile facilities

8. Other indicators

8.1 DSHA 20 Crane and lifting operations

This DSHA covers incidents involving lifting equipment and its use, which cause or could cause harm to people, the environment or material assets. It includes incidents both with and without dropped objects. DSHA 20 was established and presented for the first time in the 2015 report. This time series now comprises data for 2013-20. The analysis addresses either these seven years combined or comparisons between the years, as appropriate.

The main findings, which are also presented in the figures below, are as follows.

Fixed facilities

- Reported incidents for fixed facilities declined somewhat in 2020 compared with the year before. When normalised against working hours, on the other hand, they show a small rise, and normalised incidents for 2018-20 reveal a slightly upward trend (see figure 8.1).
- Incidents (both absolute and normalised) related to lifting in drilling modules rose substantially from 2019 to 2020. Incidents related to lifting with offshore cranes declined somewhat from 2019, but remain higher than in previous years (see figures 8.2, 8.3 and 8.5).
- Incidents <u>without</u> personal injury but with a potential for this saw a significant increase in 2019 in those cases where a person was exposed. In 2020, incidents had declined slightly again and were at roughly the same level as in earlier years (see figure 8.4).
- A positive trend was seen in 2018, which might indicate better planning of lifting operations so that fewer people were exposed when an incident occurred. This trend was clearly broken in 2019. See the preceding point. Although incidents with people exposed were rather lower in 2020 than the year before, there were still more of them than in 2018 (see figure 8.4).

Mobile facilities

- Reported incidents (both absolute and normalised) for mobile facilities show a clearly rising trend. The increase has been steady since 2017, and the number registered in 2020 is the highest for the whole 2013-20 period (both normalised and absolute). This rise reflects a number of incidents related to lifting with offshore cranes, lifting in drilling modules and other lifting activities. Normalised against working hours, the 2020 increase was largest for lifting with offshore cranes and other lifting activities (see figures 8.1 and 8.2)
- When incidents are broken down by type of lifting activity, a particular rise can be seen for lifting in drilling modules. This increase is significant in both absolute and normalised terms. Incidents in 2020 were the highest-ever in the reporting period. Normalised against working hours, however, the rise from 2019 to 2020 is only slight. That could reflect a change in acquiring information about working hours – these have risen despite a decline in wells drilled from 2019 to 2020. The trend normalised against wells drilled was therefore also considered, and shows a sharp rise in the normalised figure plus the same trend as for non-normalised incidents (see figures 8.5 and 8.6).
- Winches and electric chain hoists accounted for the largest share of the increase in incidents related to other lifting activities (see figure 8.7).
- Consideration should be given to taking a closer look at this rising trend in light of the changes which have occurred in the industry during recent years.

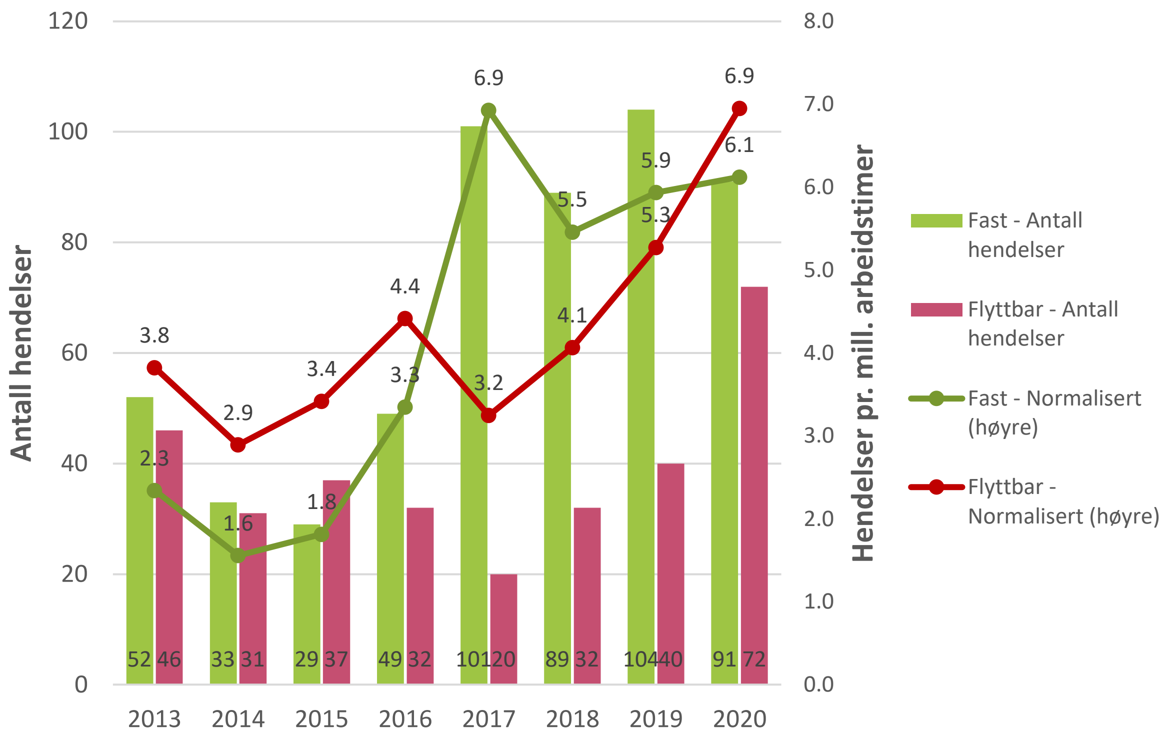

Figure 8.1 Reported incidents for crane and lifting operations in 2013-20 for fixed and mobile facilities – absolute numbers and numbers normalised against millions of working hours related to drilling and well operations and to construction and maintenance, by type of facility

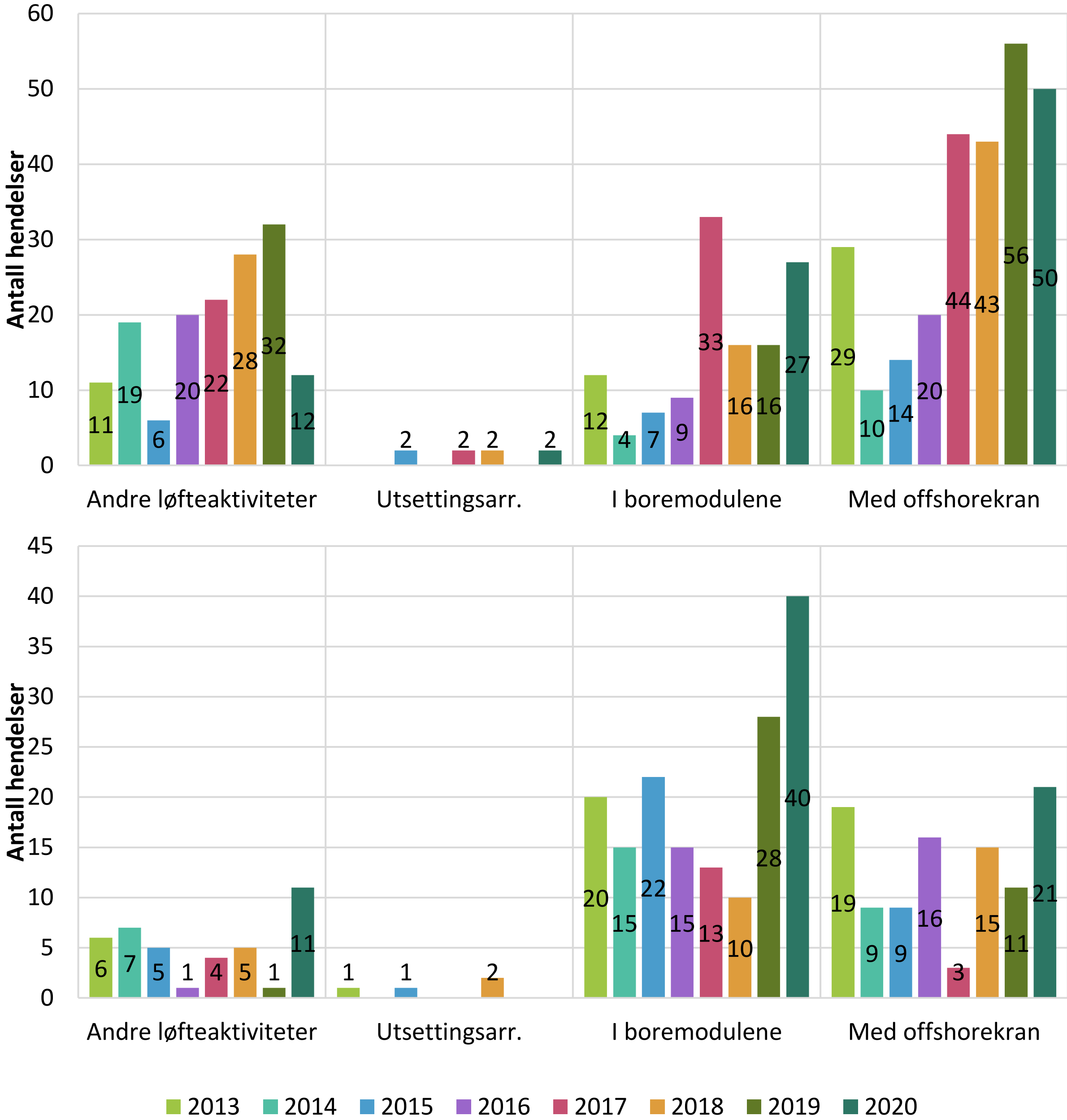

Figure 8.2 Incidents per annum for the various types of lifting activities in 2013-20, for fixed (top) and mobile (above) facilities

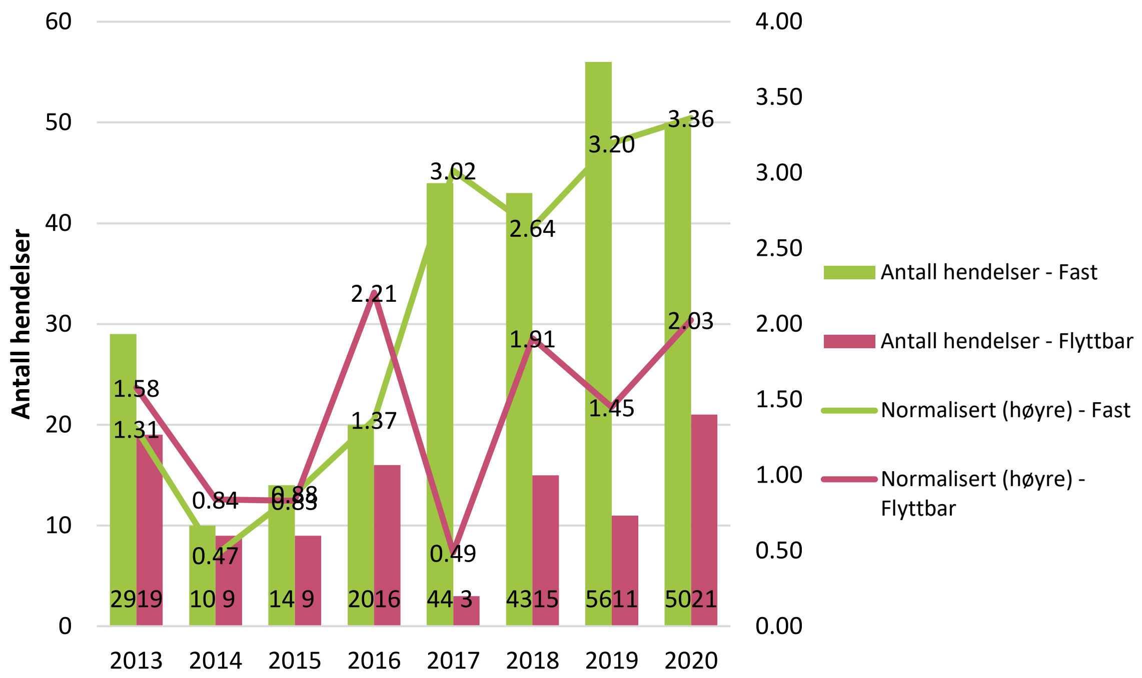

Figure 8.3 Incidents relating to lifting with offshore cranes in 2013-20 for fixed and mobile facilities – absolute numbers and numbers normalised against millions of working hours related to drilling and well operations and to construction and maintenance, by type of facility

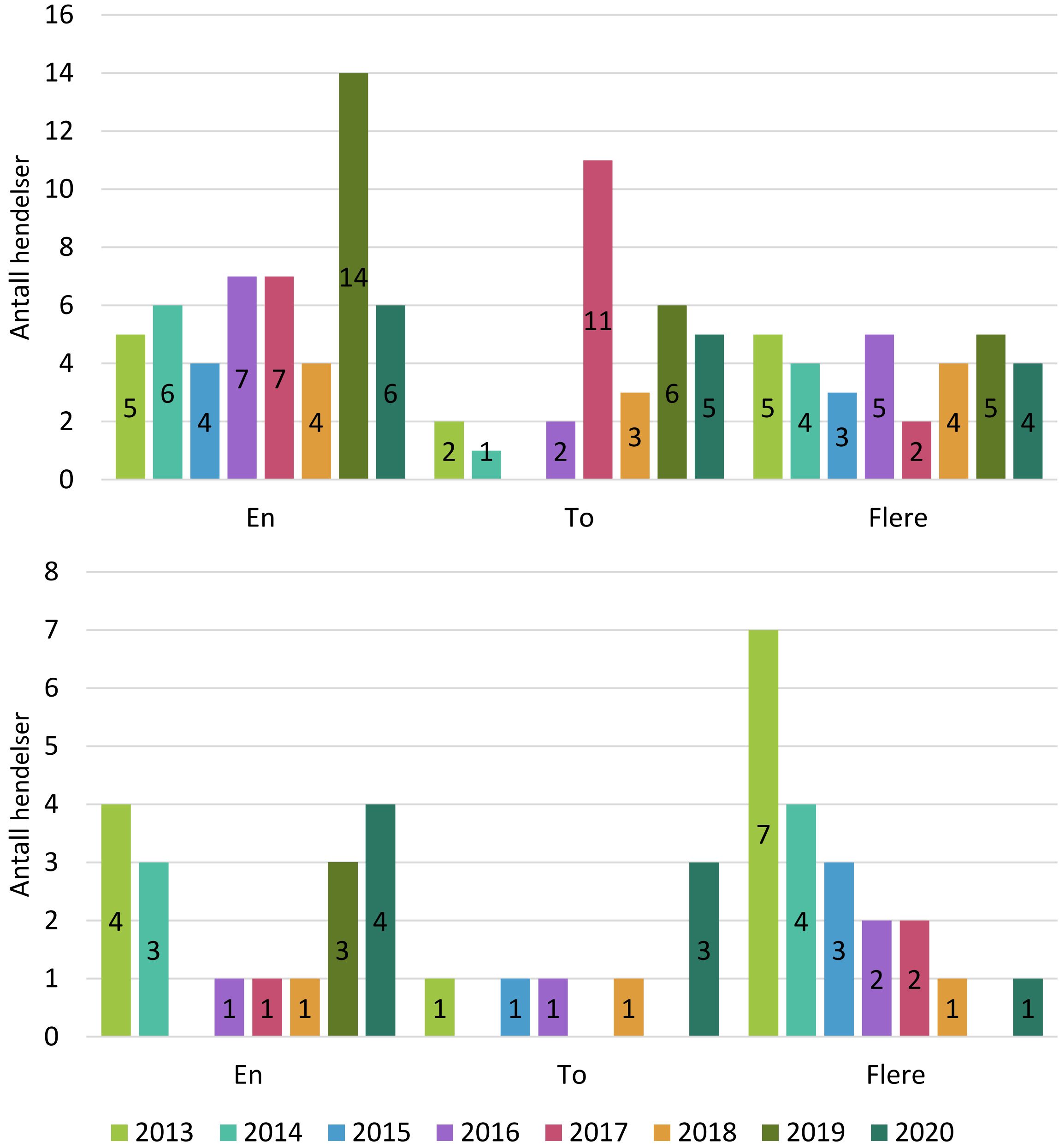

Figure 8.4 Relative number of incidents (without personal injury) involving people exposed, for fixed (top) and mobile (above) facilities in 2013-20

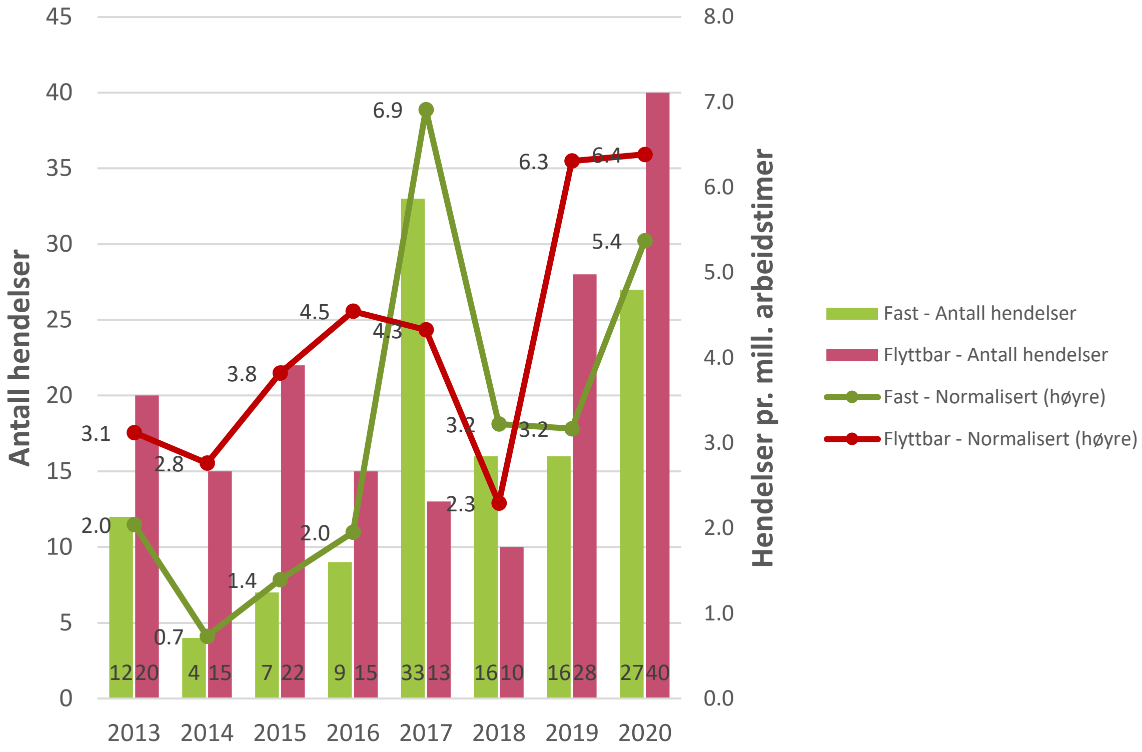

Figure 8.5 Incidents related to lifting in drilling modules in 2013-20 for fixed and mobile facilities – absolute numbers and numbers normalised against million working hours related (only) to drilling and well operations, by type of facility

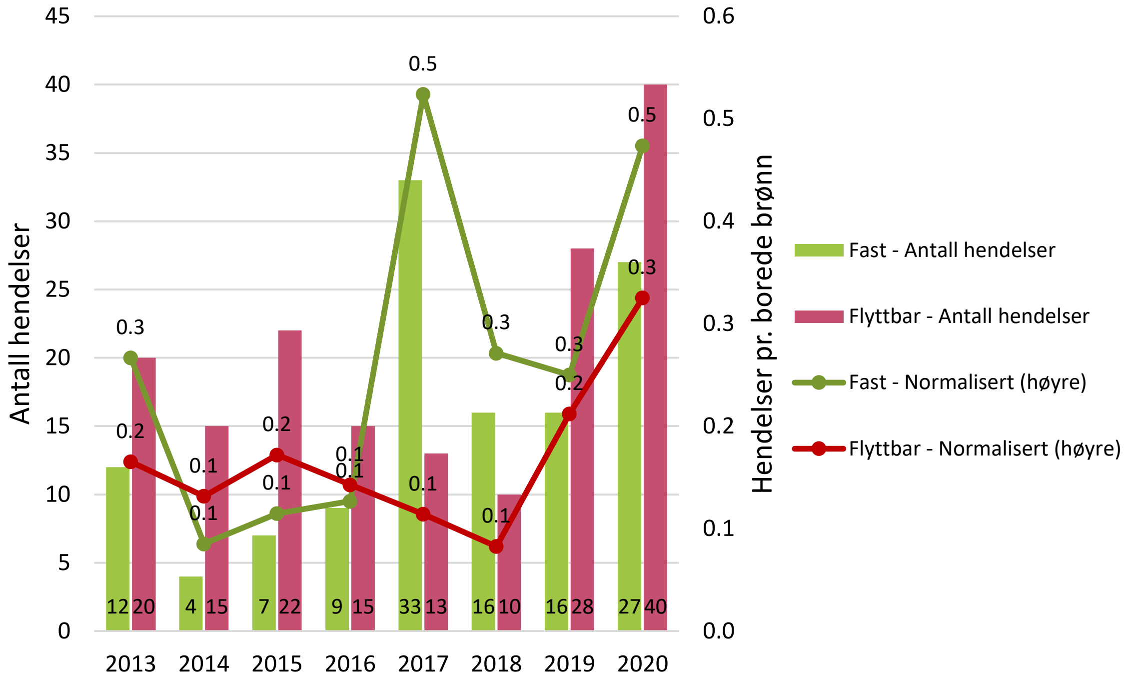

Figure 8.6 Incidents related to lifting in drilling modules in 2013-20 for fixed and mobile facilities – absolute numbers and numbers normalised against (exploration and production) wells drilled

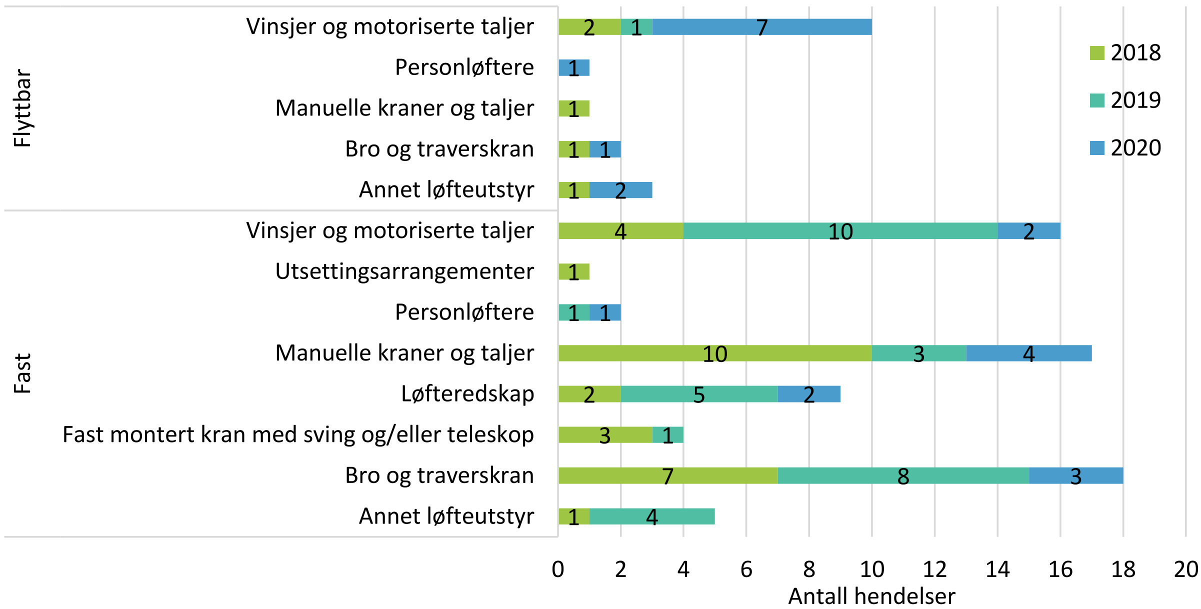

Figure 8.7 Incidents in 2018-20 related to other lifting activities by the various types of lifting equipment for fixed and floating facilities.

8.2 DSHA 21 Dropped objects

This DSHA comprises all incidents where an object drops within a facility's safety zone, either onto the deck or into the sea, with the potential to develop into an accident, and which does not involve cranes and lifting equipment and their use. Incidents linked to cranes and lifting equipment and their use are presented under DSHA 20.

A new DSHA 20 on crane and lifting operations was introduced for offshore facilities in the 2015 report, which required changes to DSHA 21 on dropped objects. The time series now consists of data for 2013-2020. The analysis addresses either these seven years combined or comparisons between the years, as appropriate.

The main findings, which are also presented in the figures below, are as follows.

Fixed facilities

- Reported incidents for *fixed facilities* declined in 2020, and were on a par with 2017-18. The normalised number was at virtually the same level as in 2019 (see figure 8.8).
- A substantial decline in incidents causing personal injury was observed in 2020. Where fixed facilities were concerned, they fell from 11 in 2019 to five. The number in both 2018 and 2019 was more than twice as high as in 2013-17, but in 2020 was closer to the pre-2018 levels (see figure 8.9). Note that the figure also includes mobile facilities, but these only experienced four such incidents over the whole period. The last three of these were in 2020 (this is commented on in the section on mobile facilities below).
- Where drilling areas are concerned, incidents with a fall energy greater than 40 joules (J) increased very considerably (tripled) from 2018 to 2019. That declined again in 2020 to the same level as in 2018. Incidents <40 J fell. This reduction related to work processes in drilling and process areas and in association with scaffolding (see figure 8.10).
- Scaffolding witnessed a substantial decline in incidents, both <40 J and >40 J, from 2019 to 2020. Where incidents >40 J are concerned, the 2020 level is roughly the same as in 2018 (see figure 8.10).
- Where scaffolding is concerned, incidents related to erection/disassembly and use declined for both <40 J and >40 J energy classes. Normalised data (incidents per

million working hours relevant for construction and maintenance) show the same trend for both energy classes (see figure 8.11).

- The trend for incidents without personal injuries but with the potential for these was negative in 2019, in that the proportion of incidents with personnel exposed (two people and more people) rose from 2018. This reversed in 2020, when the proportion was back to the pre-2019 level (see figure 8.12).
- A positive trend was seen in 2018, possibly indicating better planning of operations which might lead to dropped objects – so that fewer people are exposed when an incident occurs. This trend was clearly interrupted in 2019. See the point above. The figure declined markedly in 2020 from the year before (see figure 8.12).
- The damage potential showed a decline in the number of objects for all energy classes >40 J on fixed facilities in 2020 compared with 2019 (see figure 8.13).

Mobile facilities

- Where *mobile facilities* are concerned, an increase in reported incidents was seen during 2018 after several years with a weak declining trend. The absolute number of incidents in 2020 was up slightly from 2018 and 2019. Normalised against working hours, the number declined slightly from 2019 to 2020 (see figure 8.8).
- Three incidents involving personal injuries occurred on *mobile facilities* in 2020, an increase from earlier years. Only one incident happened in 2013-19, and that was in 2019.
- The trend for drilling areas from 2019 to 2020 was steady for both <40 J and >40 J. That applied to the absolute number of incidents. When normalised against working hours, incidents fell in 2020. This decline related primarily to work processes for operations in the drilling area. However, the fall in normalised numbers could reflect a change to information acquisition on working hours. Despite a decline in wells drilled from 2019 to 2020, working hours increased. The trend normalised against wells drilled was therefore also considered, and showed a rise in the normalised figure for both <40 J and >40 J (see figures 8.14 and 8.15).
- Dropped objects >40 J in drilling areas on mobile facilities have declined in recent years. Those in a high energy class have fallen, which is a positive trend. When the number of incidents is considered, the decline from 2019 was not very large (see figure 8.16).

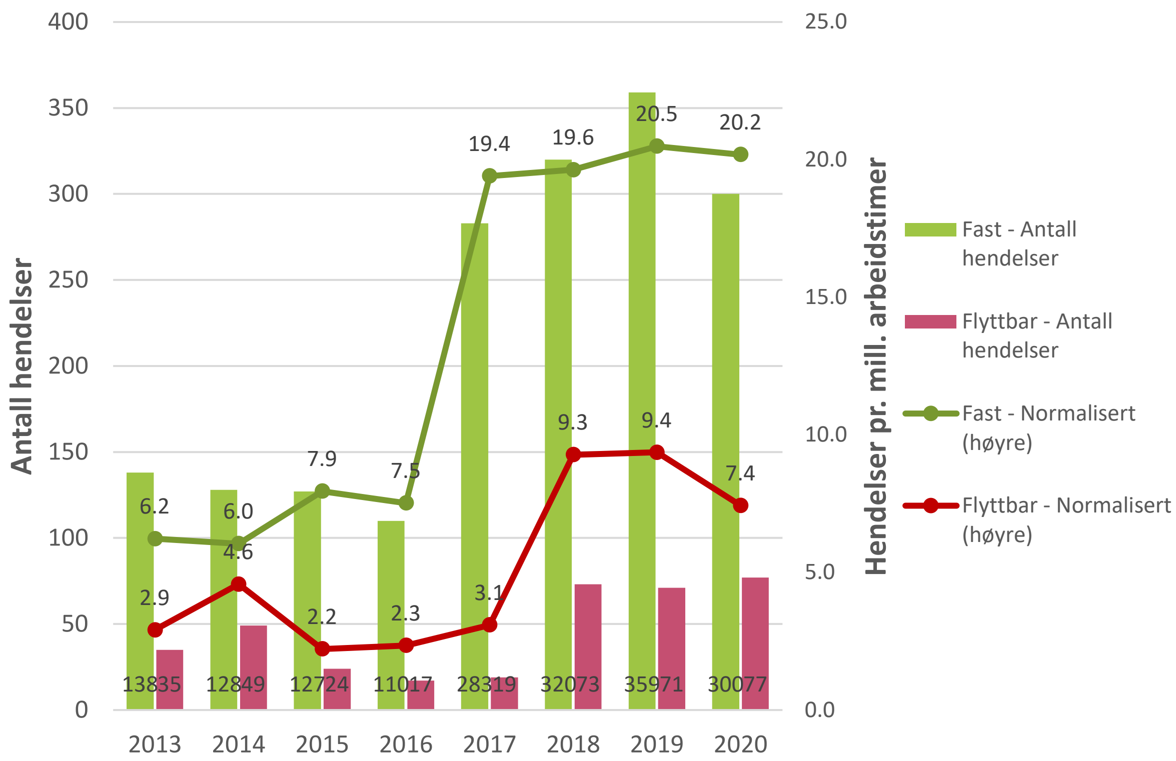

Figure 8.8 Incidents, absolute and per million working hours, classified as dropped objects broken down by fixed and mobile facilities in 2013-20

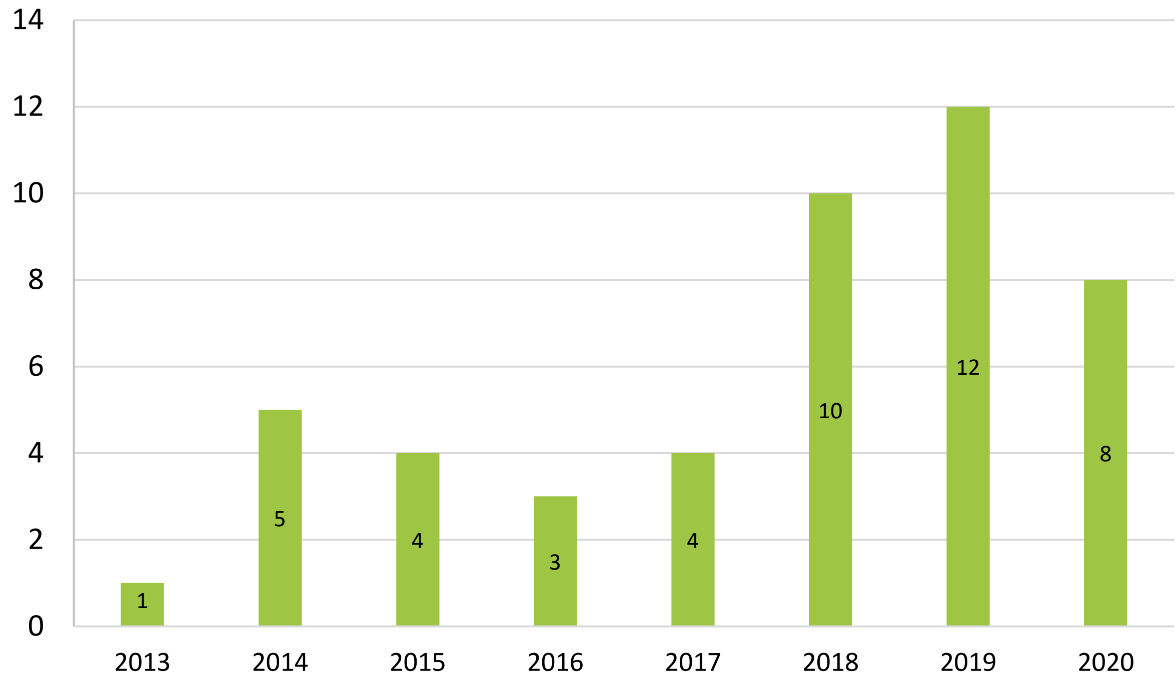

Figure 8.9 Dropped-object incidents causing personal injury in 2013-20. Only four of the incidents were on mobile facilities.

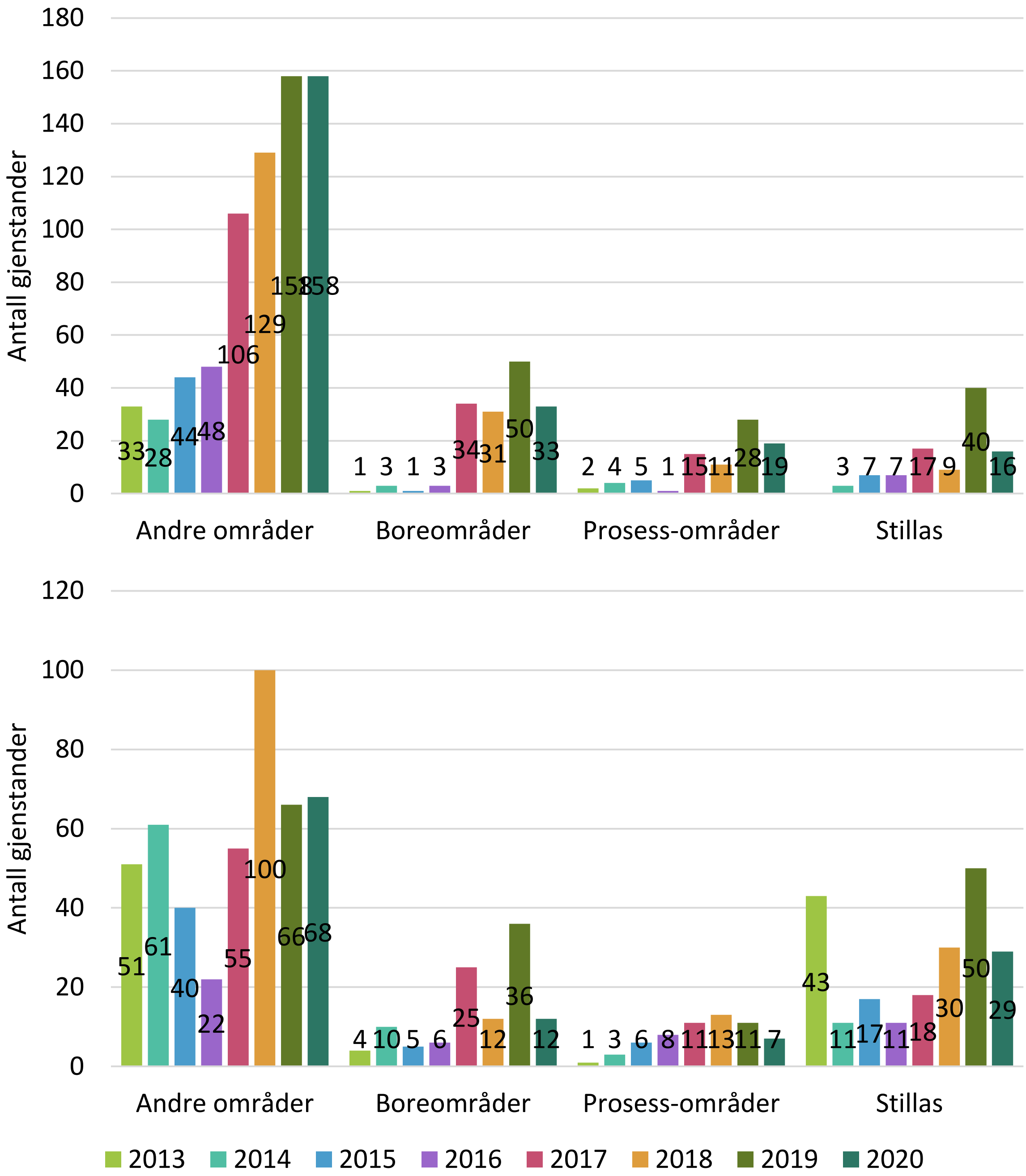

Figure 8.10 Total incidents for fixed facilities broken down between <40 J (top) and >40 J (above) by main work process categories (incidents per annum are specified in the columns) for 2013-20

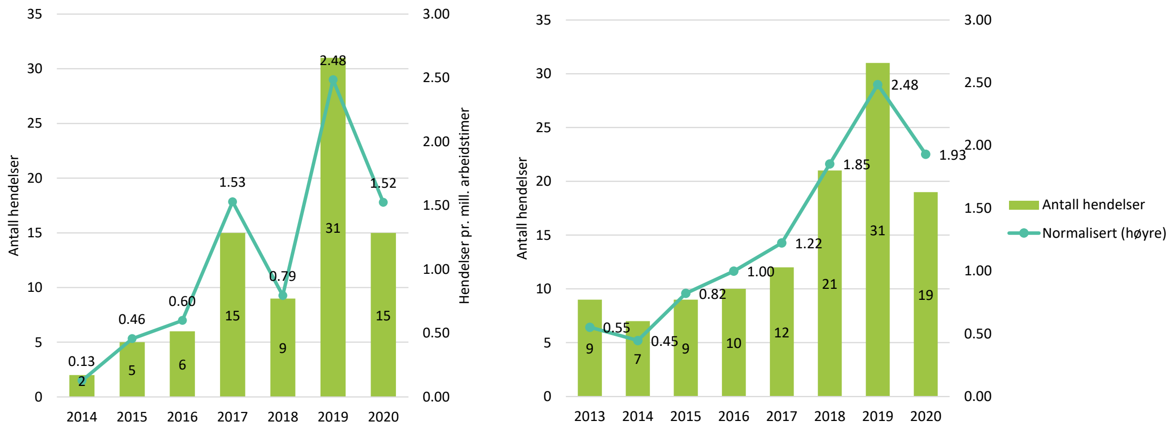

Figure 8.11 Incidents – <40 J on the left and >40 J on the right – on fixed facilities related to erecting/dismantling and using scaffolding, and normalised against working hours for construction and maintenance in 2013-20

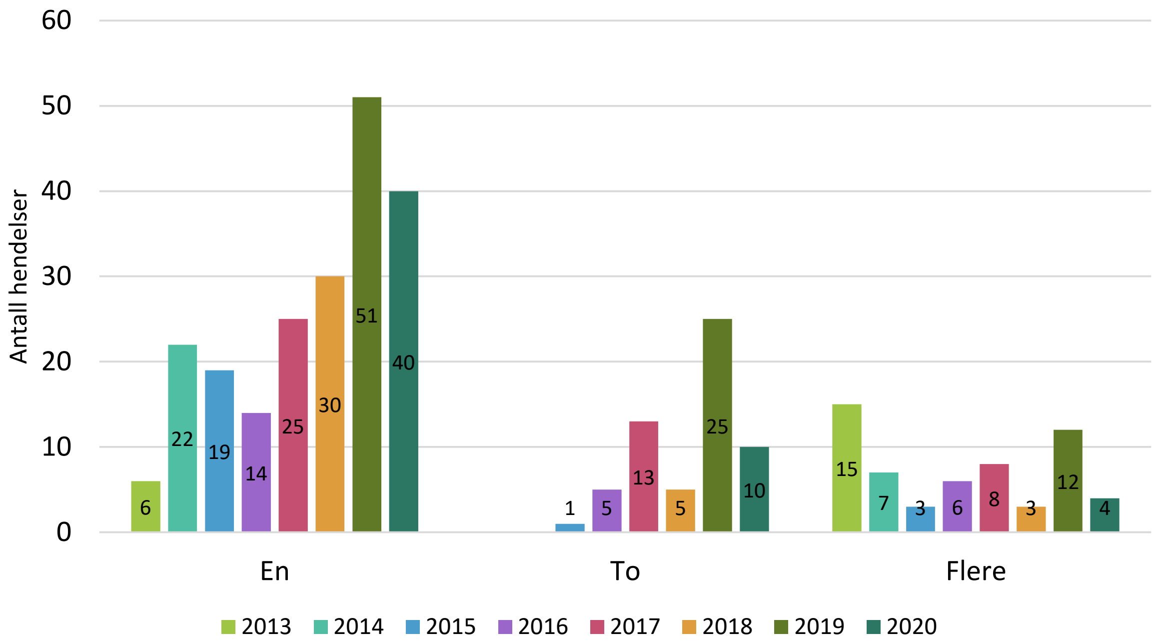

Figure 8.12 Absolute number of incidents (without personal injury) involving people exposed >40 J on fixed facilities

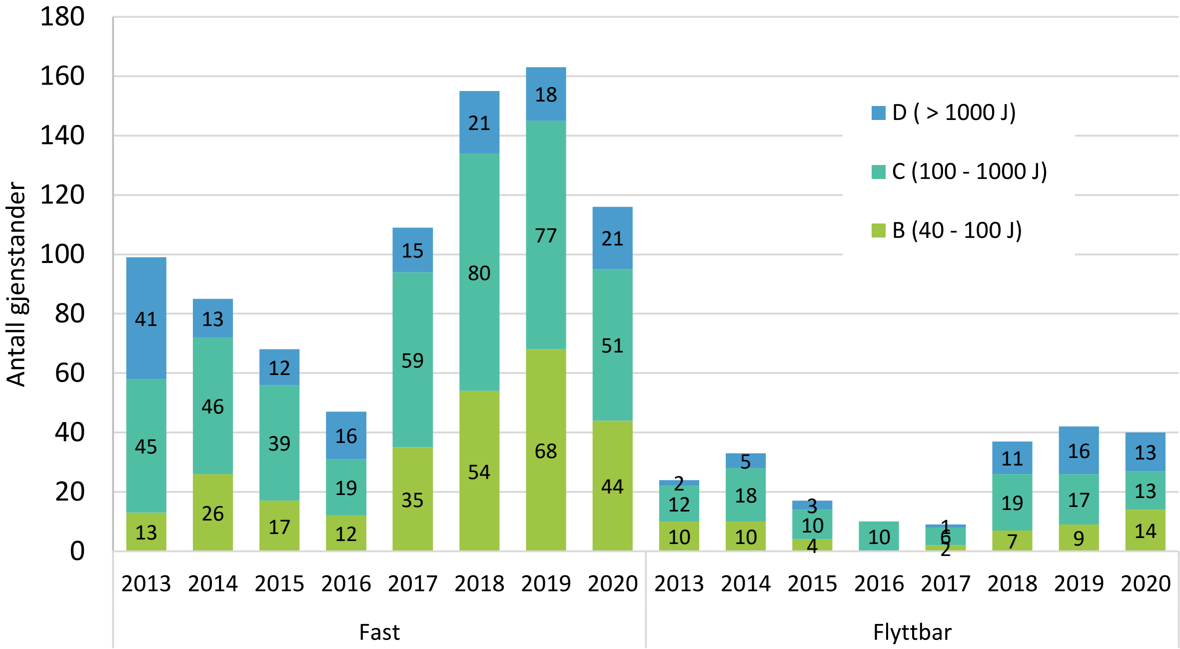

Figure 8.13 Objects by energy classes >40 J for fixed and mobile facilities in 2013-20

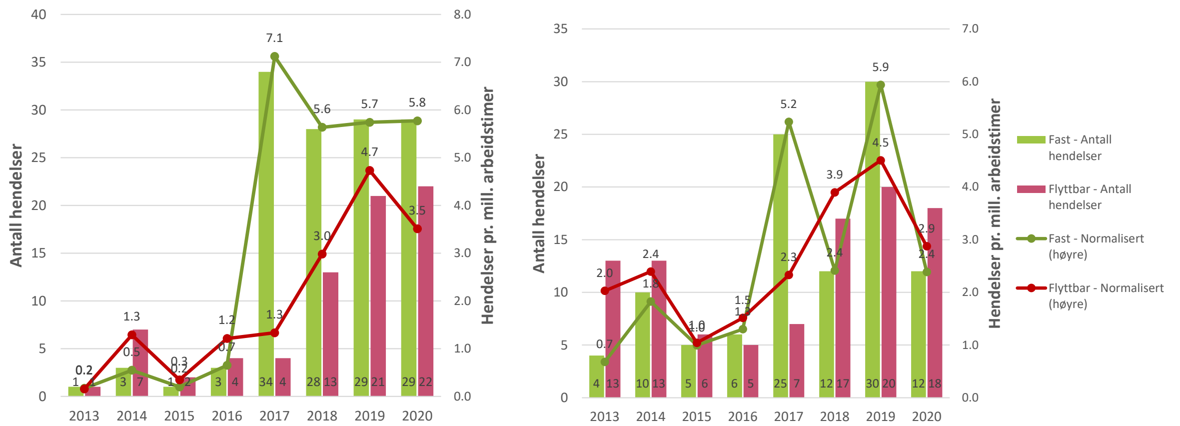

Figure 8.14 Incidents in drilling areas, <40 J to the left and >40 J to the right, by fixed and mobile facilities and normalised against drilling and well hours per annum in 2013-20

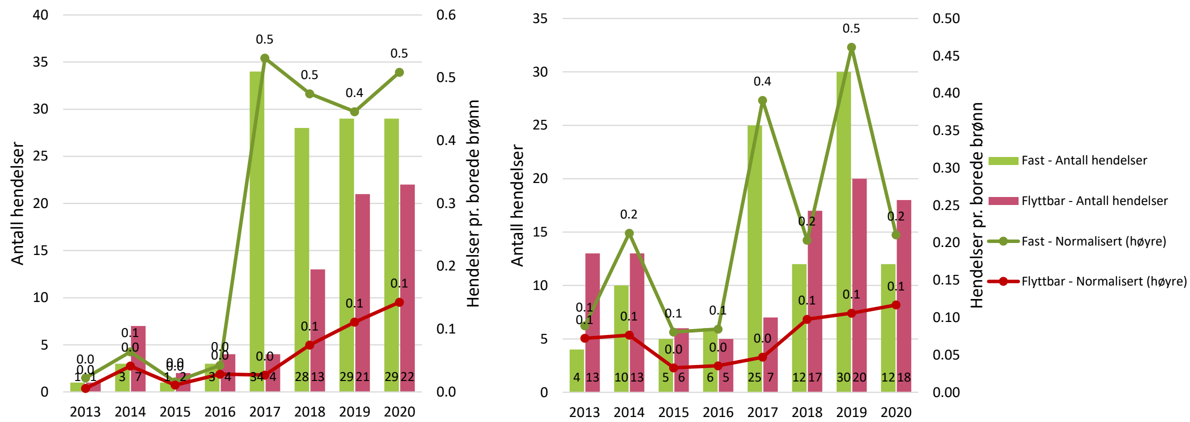

Figure 8.15 Incidents in drilling areas, <40 J to the left and >40 J to the right, by fixed and mobile facilities and normalised against wells drilled per annum in 2013-20

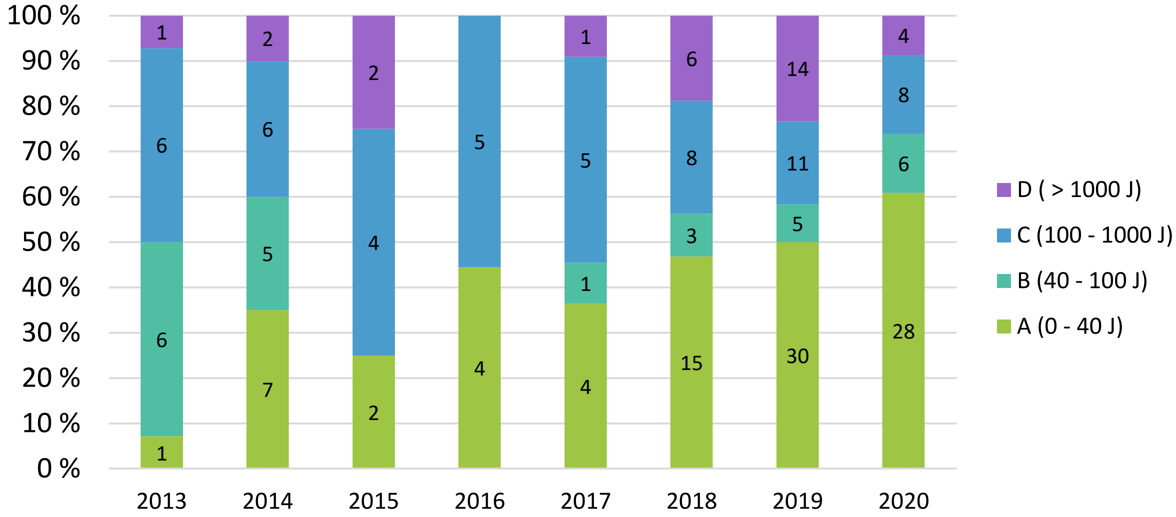

Figure 8.16 Dropped objects by energy classes in the drilling area on mobile facilities for 2013-20

8.3 Other DSHAs

The main report presents data for incidents which have been reported to the PSA, as well as for other DSHAs without major accident potential – DSHA 11, 13, 16 and 19.

9. Questionnaire-based survey for divers

A questionnaire-based survey was conducted with diving personnel on the NCS for the second time in 2020. Everyone participating in diving operations on the NCS during the year was invited to complete the questionnaire, which was by and large the same as the one used in the regular survey of offshore personnel. Some adjustments were made to incorporate diver-related topics. Results from the 2020 survey have been compared with those from 2018.

Responses were received from 70 people. Divers accounted for 53.6 per cent of this sample, with diving supervisors or personnel with other functions forming the remainder. Of the divers, the largest proportion were surface-supplied. Sixty-seven per cent of the sample were in the 41-60 age group. The proportions with permanent jobs and who had worked on the same vessel for the previous 12 months were larger than in 2018.

The distribution of shift arrangements was also fairly similar to 2018, with most (81.4 per cent) working 12/12 hours. Where working time was concerned, fewer worked only on a night shift than in 2018, and more worked both day and night shifts.

9.1 Diver-related topics

Divers and diving supervisors were asked about diving-specific working environment factors. Their responses were generally more positive than in 2018 for all questions, with the exception of one concerning umbilical length. Where differences between the groups are concerned, the divers respond more positively than the supervisors. The biggest differences concern "length of stay on board" and "restriction of umbilical length". Both divers and supervisors are positive to the use of Norsok saturation/decompression tables.

Responses differ little from 2018 on the way risk related to various conditions is rated. The areas regarded as most hazardous are "human errors during diving operations", "fatigue", "DSV lifting operations (crane or lift bags)" and "work on hydrocarbon systems". Supervisors regard risk in most areas as greater than divers do. The biggest difference is over "fatigue".

Diving supervisors were asked questions on safety-related behaviour. Roughly half of them sometimes, quite often, very often or always worried about safety during diving operations. Almost three-quarters also experienced time pressure in these operations. The divers were asked about safety-related behaviour, too. With two exceptions, their responses to all the questions were more positive than in 2018. The question which drew a more negative response concerned the condition of diving equipment, while the question of whether a medical assessment was requested when feeling unwell received the same rating as in 2018. The question on time pressure was another of those to receive the most negative responses, but showed a change for the better since 2018 and was assessed more positively than by the supervisors. Furthermore, 80 per cent of the divers responded that they were never, very rarely or quite rarely exposed to high levels of chemicals and pollution when diving.

9.2 Assessment of the HSE climate

All diving personnel were asked to respond to 53 statements on the HSE climate. Changes from 2018 were generally small. Some statements were assessed more positively, and some more negatively. None of the changes were large. The statement "I feel sufficiently rested when I am at work" received one of the lowest scores and was a negative change from 2018. The same applied to the statement that "reports about accidents or dangerous situations are often moderated". Supervisors scored more negatively than divers on the HSE indices "cooperation and communication" and "colleague involvement", but rather more positive on the "own safety behaviour" index.

9.3 Perceived accident risk

Diving personnel were presented with 13 hazard and accident situations and asked to assess the level of hazard associated with these. There were no significant changes in the assessments compared with 2018. The accident situations associated with the greatest danger were helicopter accidents, emissions/discharges of toxic gases/substances/ chemicals, dropped objects and serious work accidents.

9.4 Working environment

Where physical, chemical and ergonomic working environment exposures are concerned, most respondents mentioned working in cold areas exposed to the weather. The responses were largely unchanged from 2018. Where the psychosocial and ergonomic working environment is concerned, questions about the ability to determine one's own pace of work got the poorest responses. Many often experienced support from colleagues (85 per cent) and immediate supervisor (75 per cent), but rather fewer (about 50 per cent) often got feedback from their immediate supervisor on their work performance. Diving supervisors assess the working environment more negatively than the divers. They took a more negative view of all but one of the working environment indices (work requirements, colleague support, sleep quality, strain of working time, supervisor support and off-work). The exception was control over their work.

9.5 Off-work offshore and sleep

Diving personnel are less satisfied with the quality of food and drink in 2020 than in 2018. They also rated their quality of sleep offshore, as well as before and after an offshore tour, less favourably than in 2018. Looking at the differences between shift arrangements, those who work both day and night shifts had the least positive view of their sleep quality.

9.6 Health complaints and sickness absence

The great majority of the diving personnel assessed their own health as very good or good. At the same time, the proportion experiencing various health complaints had increased from 2018. The complaints mentioned by the largest proportions are fatigue, back pain, neck/shoulder/arm pain, joint discomfort and ringing in the ears/tinnitus. More than 40 per cent report, for example, that they had been a little/quite/very troubled by fatigue over the previous three months. Ninety-four per cent of respondents had not been absent from work because of illness over the previous year, while 3.2 per cent reported that they had been injured in a work accident with personal injury.

10. In-depth study – reporting of incidents and near-misses to the PSA

10.1 Background and purpose

The PSA's risk-based approach assumes that it is well-informed about how risk breaks down and varies between different systems, processes, activities and groups of workers. To build such knowledge, the PSA is dependent on receiving and acquiring reliable information about HSE conditions in the industry. That applies particularly to information about incidents and near-misses.

Two reporting channels are particularly important for such information. One is the immediate notifications which operators are meant to send to the PSA in the event of serious hazard or accident situations – including the written reports to be submitted for less serious hazard and accident situations. The other is the annual reporting and quality control of incidents and incident data in connection with the acquisition of information for the RNNP. Through its audits and reviews of company incident registers, however, the PSA has uncovered cases where certain reportable incidents and near-misses have not been reported through these channels. This could indicate that underreporting is a challenge in the industry, and has prompted the PSA to pay greater attention to the question of whether its risk picture is sufficiently precise and reliable.

Against that background, Proactima has been commissioned to conduct a study of reporting by the industry. This has not only concentrated on the incidence of possible underreporting but also given emphasis to possible challenges with erroneous reporting – in other words, where the information provided on an incident is formulated in such a way that the risk potential does not emerge clearly, is toned down or is (consciously or unconsciously) undercommunicated.

The study has utilised various types of data and methodologies. Questionnaire data from the RNNP have been analysed, interviews have been conducted with a number of different players in the industry, and relevant documentary sources have been reviewed – including investigation reports, reporting forms and governing documentation at the companies related to classifying and reporting incidents and near-misses.

10.2 Main challenges

Viewed as a whole, the data sources on which the study builds show that the scope of erroneous or inadequate reporting is not large. Nevertheless, errors and deficiencies in reporting do occur. These represent a lost opportunity both for follow-up by the PSA and for learning by the industry. In cases involving near-misses with a low frequency and potentially great consequences, the experience base for such incidents will be limited and the loss of learning correspondingly large. Even a small number of such near-misses which go unreported or unnotified could therefore represent a big loss.

The PSA is the last link in a long reporting chain which may involve several companies and different roles within each company. A general finding of the study is that good reporting to the PSA depends on the satisfactory functioning of reporting internally and between the companies. Another general finding is that the structural factors which underpin reporting (regulations, guidelines, classification matrices and so forth) affect its quality.

Four main challenges have been identified on the basis of the results from the study.

Strengthening the internal reporting climate in the companies

Where reporting internally in the companies is concerned, the signs are that this can be improved by toning down the attention devoted to loss-based HSE indicators and KPIs. How far and in what way such indicators relate to bonuses is uncertain. Given the unfortunate consequences this can have, however, a need exists for the industry to reassess the use of bonuses related to positive scores for loss-based HSE indicators. Such indicators could potentially lead to a position where individuals may have an interest in classifying down a given incident. Moreover, a concentration on loss-based HSE indicators appears to undermine the reporting climate and thereby to have the effect that both near-misses and personal injuries may be concealed. Giving greater emphasis to activity-based HSE indicators is for that matter also in line with recent safety literature. This typically highlights the importance of concentrating on everything which is done properly and with a successful result, rather than paying excessive attention to the few activities where things go wrong.

Clarifying roles, responsibilities and data protection requirements when reporting personal injuries

Room for improvement clearly exists for reporting personal injuries via the NAV form. This is required not only to improve information for the PSA, but also because reporting to the NAV is very important for safeguarding the individual worker's rights in the event of n occupational injury pursuant to the Norwegian National Insurance Act. First, clarification is needed of whether copies of a completed form can be sent between companies (see section 31 of the management regulations) or whether this breaches other data protection rules (see the Norwegian Personal Data Act). Second, the NAV forms used to report personal injuries should be adapted to conform with the requirements in section 31 of the management regulations concerning who should receive a copy. The practice whereby different roles take responsibility for submitting forms should also be assessed. Pursuant to section 13-14 of the National Insurance Act, the form must be submitted by the employer or the injured person. Current practice in the petroleum industry does not accord with this. Roles and responsibilities here must be made clearer to the companies.

Common basis for classifying incidents

The companies utilise various classification matrices for classifying incidents today. These are largely used by the companies to determine whether a specific incident should be notified/reported. It is natural to assume that such differences are more likely to result in varying practice than if common parameters were adopted. To create a common basis for uniform practice in classifying incidents, a common classification matrix initiated by the industry across the companies could be appropriate. A common solution for classifying well-control incidents exists today in Norwegian Oil and Gas guidelines no 135. This also contains guidance on which incidents should be notified/reported to the PSA.

Improved practice for notifying/reporting hazard and accident situations

The study identifies an improvement potential for the practice related to notification/ reporting of hazard and accident situations pursuant to section 29 of the management regulations. Documents reviewed in the study refer both to incidents which have not been notified/reported and to written reports where the potential does not emerge clearly. Several relevant measures could be adopted to improve this practice, and are also proposed by informants to the study. First, the expression "under slightly different circumstances" is subject to different interpretations. That can lead to variations in practice concerning which near-misses are notified/reported across the companies. This expression should therefore be clarified. Second, a number of companies find the guidelines to the relevant management regulation unclear. Specifically, this is because the hazard and accident situations cited as examples in the guideline are not clearly related to the potential of an incident or to section 29, paragraph 1, litera a-e of the management regulations. This should be clarified. Third, the media's right of access appears to influence how report texts are formulated. Vague and brief reports could veil the potential of a given hazard and accident situation. An assessment should be made of whether written reports are influenced by this consideration to such an extent that the documents can be exempted from the right of access for a certain period (see section 24, paragraph 1 of the Norwegian Freedom of Information Act). Fourth, the study shows that written notifications/reports from the operator companies could be shared to a greater extent with contractors, shipping companies and safety delegates. That could function as an important control mechanism for notification and report texts sent to the PSA.

11. Definitions and abbreviations

11.1 Definitions

See sub-sections 1.10.1-1.10.3 and sub-section 5.2 in the main report.

11.2 Abbreviations

For a detailed list of abbreviations, see PSA, 2020a. The most important abbreviations in this report are:

Codam	Database for damage to structures and subsea facilities
BDV	Blowdown valve
BOP	Blowout preventer
Bora	Barrier and operational risk analysis
CM	Corrective maintenance
DDRS/CDRS	Database for drilling and well
DHSV	Downhole safety valve
DSHA	Defined situations of hazards and accidents
DSYS	PSA database for personal injuries and exposure hours in diving activities
ESDV	Emergency shutdown valve
GM	Metacentre height of floating facilities
HSE	Health, safety and the environment
KG	Distance from keel to centre of gravity on floating facilities
KPI	Key performance indicator
NCS	Norwegian continental shelf
NAV form	Norwegian Labour and Welfare Administration form for reporting injuries
PM	Preventive maintenance
PSA	Petroleum Safety Authority Norway
PSV	Pressure safety valve
RNNP	Trends in risk level in the petroleum activity
WIF	Well Integrity Forum

12. References

For detailed reference lists, see the main reports:

PSA, 2020a. Risk level in the petroleum activity – Norwegian continental shelf, main report, 2 April 2020

PSA, 2020b. Risk level in the petroleum activity – onshore plants, 2 April 2020

PSA, 2020c. Risk level in the petroleum activity – methodology report, 2 April 2020