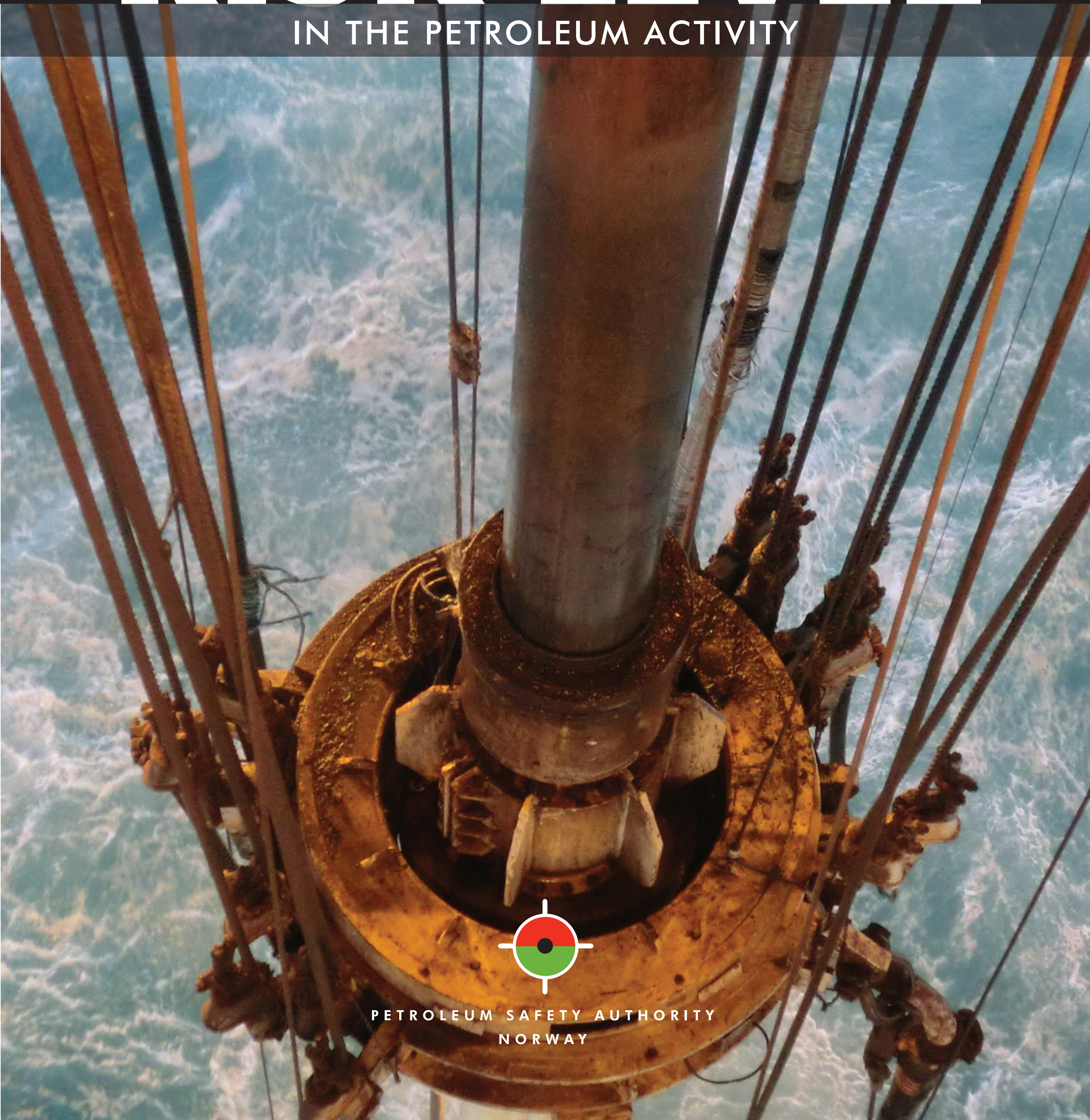
SUMMARY REPORT 2013 - NORWEGIAN CONTINENTAL SHELF

TRENDS IN RISK LEVEL

IN THE PETROLEUM ACTIVITY



PETROLEUM SAFETY AUTHORITY
NORWAY

Preface

Trends in the risk level in the petroleum industry concern all parties involved in the industry, as well as the general public. It was therefore natural and important to establish an instrument to measure the impact of the industry's overall HSE work.

RNNP as a tool has developed considerably since its introduction in 1999/2000 (first report published in 2001). This development has taken place through a multipartite collaboration, characterised by agreement on the prudence and rationality of the selected course of development in terms of creating a basis for a shared perception of the HSE level and its development in an industry perspective. The work has taken on an important position in the industry in that it contributes toward forming a shared understanding of the risk level. The first RNNP report concerning acute spills to sea was published in 2010. The report is based on RNNP data combined with data from the Norwegian Oil and Gas Association's Environmental Web database. Due to the data collection period in Environmental Web, the RNNP report on acute spills will not be published until autumn.

The petroleum industry has considerable HSE expertise. We have utilised this expertise by facilitating open processes and inviting contributions from key personnel from operating companies, helicopter operators, consultancies, research and teaching.

Objectivity and credibility are key for any qualified statements regarding safety and the working environment. We therefore depend on the parties having a shared understanding of the reasonableness of the methodology employed, and of the value created by the results. The parties' ownership of the process and the results is therefore important.

Many people have contributed to the execution, both internally and externally. It would take too long to list all the contributors, but I particularly want to mention the positive attitude we have encountered in our contact with the parties in connection with execution and further development of the work.

Stavanger, 24 April 2014

Finn Carlsen,
Director for Professional Competence

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1. Objective and limitations

1.1 Purpose

The "Trends in risk level on the Norwegian Continental Shelf" project started in the year 2000. The Norwegian petroleum activities have gradually evolved from a developmental phase with many large fields, to a phase dominated by operation of petroleum facilities. Today, the petroleum activities are characterised by such issues as ageing facilities, exploration and development in environmentally sensitive areas, as well as development of smaller and financially weaker fields. The licensee landscape is also changing, as more and more new licensees are participating in activities on the Norwegian Continental Shelf (NCS). In addition, the industry's current activity level is high. The development in petroleum activities must take place in a perspective where the HSE conditions are constantly improving. It is therefore important to measure the impact of the industry's overall safety work.

The industry has traditionally used a selection of indicators to illustrate safety trends in the petroleum activities. The use of indicators based on the frequency of lost-time incidents has been particularly widespread. Such indicators only cover a small part of the overall safety picture. There has been a development in recent years where multiple indicators are used to measure trends in a few key HSE factors.

The Petroleum Safety Authority Norway (PSA) wants to create a differentiated picture of risk level trends based on information from several sides of the industry, so that the impact of the industry's overall safety work can be measured.

1.2 Objective

The objective of the work is to:

- Measure the impact of the industry's HSE work.
- Contribute to identifying areas that are critical for HSE and where the effort to identify causes must be prioritised in order to prevent undesirable incidents and accidents.
- Increase insight into potential causes of accidents and their relative significance for the risk profile, e.g. to provide a better basis for decisions for the industry and authorities concerning preventive safety and emergency preparedness planning.

The work may also contribute to identifying focus areas for amending regulations, as well as research and development.

1.3 Key limitations

In this report, the focus is personnel risk, and includes major accidents, occupational accidents and working environment factors. Both qualitative and quantitative indicators are used. A questionnaire-based survey is conducted under the auspices of RNNP every other year. Such a survey was conducted for this report. A qualitative analysis of causes and measures associated with structural and maritime related incidents has also been carried out.

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

- All production and mobile facilities on the NCS, including subsea facilities.
- Passenger transport by helicopter, from departure/arrival from helicopter terminals to landing/departure at the facilities.
- Use of vessels within the safety zone around the facilities.

Onshore facilities in the PSA's administrative area are included as of 1 January 2006. Data collection started from this date, and separate reports have been published since then. Outcomes and analyses for onshore facilities and the results from these facilities are not included in this summary report. Since 2010, a separate report has been published with a focus on acute spills to sea from offshore petroleum activities. This year's report concerning acute spills is expected during the autumn of 2014.

2. Conclusions

In this work, the PSA seeks to measure trends in the risk level as regards safety, the working environment and the external environment[1], by using a number of relevant indicators. The basis for the assessment is the triangulation principle, i.e. using multiple measuring instruments to measure the same phenomenon; in this case, trends in risk level.

Trends are the main focus. It must be expected that some indicators, particularly within a limited area, will at times display large annual variations. The petroleum industry should therefore focus on the positive development of long-term trends, particularly in light of Parliament's goal for the Norwegian petroleum industry to be a world leader in HSE.

Ideally, one should arrive at a comprehensive conclusion on the basis of information from all the measurement instruments used. In practice, this is complicated, for example because the indicators reflect HSE conditions at levels that may be significantly different. This report particularly examines risk indicators associated with:

- Major accidents, including helicopter-related accidents
- Selected barriers associated with major accidents
- Serious personal injuries
- Risk factors in the working environment
  - Chemical working environment
  - Noise exposure harmful to hearing
  - Ergonomic factors
- Qualitative assessments for selected areas.

In 2013, for the seventh time, a comprehensive questionnaire-based survey was conducted among personnel working on the Norwegian Continental Shelf (NCS). This survey has been conducted every other year since 2001. Even though the questionnaire is being continuously developed, the core of the survey remains the same. This yields a unique series of data with opportunities for in-depth investigations.

The results from the questionnaire-based survey presented in the report provide an overall picture of the employees' assessment of occupational health and safety in their own workplaces. The overall assessment is that the HSE climate has improved. At the same time, it is apparent that there are still challenges in the same areas as in previous years. These include the quantity of procedures and routines, deficient maintenance and difficulties relating to lack of a common language.

Overall, the accident risk is perceived to be unchanged from 2011, but in certain areas it is assessed as higher. This applies to the risks associated with helicopter accidents, sabotage/terror and failures in load-bearing structures or loss of buoyancy. The employees perceive the highest accident risk to be associated with falling objects, gas leaks and serious occupational accidents.

The employees’ assessment of the physical, chemical and ergonomic working environment does not appear to have changed to a notable degree compared with 2011. Where there are significant changes, they are for the better. Those areas which have previously been highlighted as challenging, such as working in a crouching position, working with the hands above shoulder height, sedentary work, and lifting with the upper body twisted or bent over, are still perceived as difficult areas. Well over one third of employees respond that they are exposed to high noise levels, which is also unchanged from 2011. There are however positive significant changes associated with skin contact with, for example, oil or chemicals, and chemical odours and airborne dust. In terms of

[1] Data collected through RNNP is used along with data from the Environmental Web database to assess acute spills to sea. The results will be presented in a separate report to be published in the autumn.

the psycho-social working environment, the results show significant improvements, especially as concerns support, assistance and feedback from managers.

Most of those who responded to the survey assessed their own health and ability to work in relation to mental and physical requirements as good or very good. At the same time, it is apparent that many of the employees have one or more health complaints to one degree or another. As in previous years, the commonest reports of health complaints are of pains in the neck, shoulders, arms, back, knees and hips, and impaired hearing.

In 2013, 9 hydrocarbon leaks exceeding 0.1 kg/s were recorded. This is the second-lowest number recorded in the period (1996-2013). The number of leaks in 2013 represents a 50% increase over 2012. During the year, one leak was recorded in the 1-10 kg/s category, while the others were between 0.1 and 1 kg/s. This means that the risk contribution in 2013 is one of lowest recorded in the period 1996-2013. A comparison of the leak frequency per operator shows that there are still relatively large differences between operators.

In 2013, 13 well control incidents were registered. Eleven of these incidents were in the lowest risk category, while the two others were in the medium category. This is the same number of incidents as in 2011 and a slight fall from 2012. The decline in production drilling incidents is significant. Within exploration drilling, the variation is much greater. The level of the last four years is higher that than of the previous four-year period.

In 2013, there were no leaks from risers within the safety zones of manned facilities.

Incidents associated with structures and maritime systems showed an increase from three incidents in 2010 to 12 in 2012. In 2013, there were 10 incidents, of which three were linked to anchoring systems, one to DP systems, three to stability, one to internal cracks and two to cracks in the main load-bearing structure. The high number of incidents in the last three years indicates that the positive trend observed in the previous period has been broken. A separate qualitative study to examine structural and maritime incidents more closely is discussed in this year's RNNP reports.

Only two ships on collision courses were registered in 2013, and this is the lowest recorded for the period 2002-2013. The 2013 level is significantly lower than the average for the period 2005-2012. Here the impact of sea areas around the facilities controlled by dedicated traffic centres must be ascribed as a clear causal factor.

The other indicators reflecting near-misses with major accident potential show a stable level with relatively minor changes from 2012 to 2013.

The total indicator which reflects the potential for loss of life if registered near-misses develop into actual incidents is a product of the number of registered incidents and their potential consequences. A historical risk indicator does not express risk, but may be used to assess trends in the parameters contributing to risk. A positive development in an underlying trend for this type of indicator therefore provides an indication that we are achieving better control of the contributors to risk. Or, in other words, that risk management is improving.

The total indicator in 2013 is at its lowest level for the period since 1996. This is due to the number of incidents having fallen, and none of them having had a very large inherent potential for causing many fatalities if they had developed. The value in 2013 is on the threshold of being a significant reduction. This is also the case when examining the trend in the light of a three-year rolling average. Over the last 4-5 years, the total indicator (three-year rolling average), for both production facilities and mobile facilities, has flattened out at a level which is below the previous period.

Helicopter risk constitutes a large share of the overall risk exposure to which employees on the NCS are exposed. The purpose of the risk indicators used in this work is to capture the real risk involved in the incidents included in the survey and to identify areas with improvement potential. Among other things, an expert group has been established under the auspices of RNNP to assess the risk associated with the most serious incidents. The expert group consists of personnel with pilot, technical, ATM and risk expertise.

The indicator which reflects the most serious incidents and which is being assessed by the expert group shows, under a conservative assessment, a small increase from 2012 to 2013. In the last five years, there have been no incidents registered with "little remaining safety margin". For 2013, there were two incidents in the indicator for "medium remaining safety margin": one relating to an emergency landing by a Sikorsky S92 helicopter due to a problem with the main rotor, and one relating to an evasive manoeuvre due to a weather balloon.

Barrier indicators are an example of leading indicators. The indicators show that there are somewhat significant level differences between the facilities, not only in 2013, but also over the last ten years. Some facilities have relatively poor results for certain barrier systems.

Maintenance management data has been collected for four years. The figures from 2010 to 2013 show no significant improvement associated with maintenance management. For production facilities, the total volume of outstanding corrective maintenance and backlog of preventive maintenance is at the same level in 2013 as in 2012. The level for outstanding corrective maintenance in 2013 is however considerably higher than for 2010 and 2011. Outstanding corrective maintenance of the volumes reported will itself contribute to risk.

The reported data for backlogs in preventive maintenance and outstanding corrective maintenance for mobile facilities shows great variation. This is similar to what we have seen in recent years. The PSA wishes to open a dialogue with the industry on this topic through the Norwegian Shipowners' Association.

Serious personal injuries have shown a positive trend in recent years. The injury frequency rate is now 0.48 serious injuries per million working hours for the entire NCS. This is significantly lower than the average for the preceding ten-year period. There was a significant reduction for production facilities in 2013, compared with the previous ten-year period. In 2013, the injury rate for operators' employees (on production facilities) rose relative to 2012, while the rate for contractors' employees fell. The 2013 injury rate for contractors' employees on production facilities was below the value expected based on the preceding ten-year period, which is a highly positive development. The injury rate on mobile facilities showed a slight increase in 2013 compared with 2012, but is still considerably lower than the level in the period 2003-2008.

The noise indicator shows an improvement for two out of 11 position categories from 2012 to 2013. This applies to the position categories of surface treatment personnel and rig mechanics. For eight position categories, there has been a negative trend over the last year, after several years of positive trends for a number of them. The noise indicator for the position categories of motorman and surface treatment personnel are considerably higher than for other groups. For this group, the noise indicator including ear protection is also relatively high.

The industry project for noise reduction in the petroleum activities that was initiated in 2011 is expected to contribute towards improvement in the noise indicator over time. Based on this year's result, this work has not produced any effects in the present reporting period.

The indicator for the chemical spectrum's hazard profile shows that there is still considerable variation between facilities with regard to the number of chemicals in use. To a certain degree, the variation reflects the type of facility and activities on the facility.

Permanent installations generally have a higher number of chemicals in circulation than mobile facilities.

The indicator which describes risk associated with chemical exposure for position categories shows that short-term assessments for mechanics and process operators are highest for permanent installations. Short-term assessments for mechanics and full-shift assessments for surface treatment personnel are highest for mobile facilities.

The indicators which describe ergonomic risks show that the six selected position categories on production facilities experienced a decline in the red score for combined assessment of all work tasks compared with 2012. Compared with the period 2010 to 2012 where surface treatment personnel had the highest score for combined assessment, in 2013 it was roughnecks and scaffolders who reported the highest score for combined assessment. For the roughnecks, it is their working position that constitutes the greatest ergonomic risk, while for scaffolders it is lifting and carrying and then working position. For mobile facilities, it is still the roughnecks who, despite a fall since 2012, have the highest score for combined assessment of all work tasks. For roughnecks, catering and mechanics, it is working position and lifting and carrying that constitute the greatest ergonomic risks.

Part 2: Execution and scope

3. Execution

The work in 2013 is a continuation of previous years' activities, carried out in the period 2000-2013; see NPD (2001), NPD (2002), NPD (2003), PSA (2004), PSA (2005), PSA (2006), PSA (2007), PSA (2008), PSA (2009), PSA (2010), PSA (2011) and PSA (2013). (Complete references are provided in the main report, as well as at www.ptil.no/rnnp). This year we have continued the general principles and have further developed the reporting with special emphasis on:

- The work on analysing and evaluating data related to defined hazard and accident situations has been continued, both on the facilities and for helicopter transport.
- A considerable volume of empirical data on barriers against major accidents was collected and analysed in the same way as in the period 2003-2012. Greater emphasis has been placed on nuances in the data for well barriers and BOP.
- Comprehensive questionnaire-based survey.
- Indicators for noise, chemical working environment and ergonomics have been continued.
- Qualitative study of DFU8 – Structural and maritime related incidents.
- Data from onshore facilities have been analysed and presented in a separate report.
- Acute spills to sea and potential spills to sea are undergoing analysis, and will be presented in a separate report.

3.1 Execution of the remit

The work on this year's report began in autumn 2013. The following organisations and people participated:

• Petroleum Safety Authority Norway:	Responsible for execution and further development of the work
• Operating companies and shipowners:	Contribute data and information about activities on the facilities, as well as in the work on adapting the model for onshore facilities, which have been included as of 1 January 2006
• Civil Aviation Authority Norway:	Responsible for reporting public data regarding helicopter activities and quality assurance of data, analyses and conclusions
• Helicopter operators:	Contribute data and information about helicopter transport activities
• HSE discipline group: (selected specialists)	Evaluate the procedure, input data, viewpoints on the development, evaluate trends, propose conclusions
• Safety Forum: (multipartite)	Comment on the procedure, results and recommend further work
• Advisory group: (multipartite)	Multipartite RNNP advisory group that advises the Petroleum Safety Authority regarding further development of the work.

The following external parties have assisted the Petroleum Safety Authority with specific assignments:

- Terje Dammen, Jorunn Seljelid, Beate R. Wagnild, Robert Ekle, Grethe Lillehammer, Aud Børsting, Inger Krohn Halseth, Rolf Johan Bye, Reidun Værnes, Trond Stillaug Johansen, Kai Arne Jenssen, Lina Berentsen, Asbjørn Gilberg, Stein Haugen, Stian Antonsen, Vibeke F. Een and Helene Kjær Thorsen, Safetec
- Astrid Solberg, Randi Austnes-Underhaug, Kathrine Skoland and Stian Bayer, IRIS
- The PSA's work group consists of: Einar Ravnås, Bjørnar Heide, Øyvind Lauridsen, Mette Vintermyr, Arne Kvitrud, Trond Sundby, Hilde Nilsen, Inger Danielsen, Elisabeth Lootz, Sigvart Zachariassen, Brit Gullesen, Hans Spilde, Semsudin Leto, Eivind Jåsund and Torleif Husebø.

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

- Erik Hamremoen, Norwegian Oil and Gas Association, represented by LFE
- Egil Bjelland, Dag Vidar Jensen, Morten Haugseng, CHC Helikopter Service
- Kjetil Heradstveit, Tom Idar Finnestad, Caspar Smith, Bristow Norway AS

Numerous other people have also contributed to the work.

3.2 Use of risk indicators

Data has been collected for hazard and accident situations associated with major accidents, work accidents and working environment factors, specifically:

- Defined hazard and accident situations, with the following main categories:
    - Uncontrolled discharges of hydrocarbons, fires (i.e. process leaks, well incidents/shallow gas, riser leaks, other fires)
    - Structural integrity related incidents (i.e. structural damage, collisions, risk of collision)
- Test data associated with the performance of barriers against major accidents on the facilities, including data concerning well status and maintenance management
- Accidents and incidents in helicopter transport
- Work accidents
- Noise, chemical working environment and ergonomics
- Diving accidents
- Other hazard and accident situations with consequences of a lesser extent or significance for preparedness.

The term 'major accident' is used in many places in the reports. There are no unambiguous definitions of the term, but the following are often used, and coincide with the base definition employed in this report:

- A major accident is an accident (i.e. entails a loss) where at least three to five people may be exposed.
- A major accident is an accident caused by failure of one or more of the system's built-in safety and emergency preparedness barriers.

Viewed in light of 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 DFUs (defined hazard and accident conditions) related to major accidents is founded in part on existing databases in the Petroleum Safety Authority (CODAM, DDRS, etc.), but also to a significant degree on data collection carried out in cooperation with the operating companies and shipowners. All incident data has been quality-assured by for example checking it against the incident register and other databases in the Petroleum Safety Authority.

Table 1 shows an overview of the 19 DFUs, and which data sources have been used. The industry has used the same categories for registering data through databases such as Synergy.

3.3 Developments in the activity level

Figure 1 and Figure 2 show the developments over the period from 1996 to 2013 for production and exploration activities, of the parameters used for normalisation against the activity level (all figures are relative to the year 2000, which has been defined as 1.0). Appendix A to the main report (PSA, 2014a) presents the underlying data in detail.

Table 1 Overview of DFUs and data sources

DFU no.	*DFU description*	*Data sources*
1	Non-ignited hydrocarbon leak	Data collection*
2	Ignited hydrocarbon leak	Data collection*
3	Well incident/loss of well control	DDRS/CDRS + incident reports (PSA)
4	Fire/explosion in other areas, combustible liquid	Data collection*
5	Ship on collision course	Data collection*
6	Drifting object	Data collection*
7	Collision with field-related vessel/facility/shuttle tanker	CODAM (PSA)
8	Damage to platform structure/stability/anchoring/positioning fault	CODAM (PDA) + the industry
9	Leak from subsea production facility/pipeline/riser/wellstream pipeline/loading buoy/loading hose	CODAM (PSA)
10	Damage to subsea production equipment/pipeline systems/diving equipment caused by fishing gear	CODAM (PSA)
11	Evacuation (precautionary/emergency evacuation)	Data collection*
12	Helicopter crash/emergency landing on/near facility	Data collection*
13	Man over board	CODAM (PSA)
14	Personal injury	PIP (PSA)
15	Work-related illness	Data collection*
16	Full loss of power	CODAM (PSA)
18	Diving accident	DSYS (PSA)
19	H_2S emission	Data collection*
21	Falling object	Data collection*

* Data collection is carried out in cooperation with the operating companies

The number of working hours on production facilities has reached its highest level in 2013. On mobile facilities, the variations from year to year are greater than for production facilities, but here too the number of working hours in 2013 is the highest during the period. A presentation of DFUs or risk can sometimes be different if absolute or "normalised" values are stated, depending on the normalisation parameter. In the main, normalised values are presented.

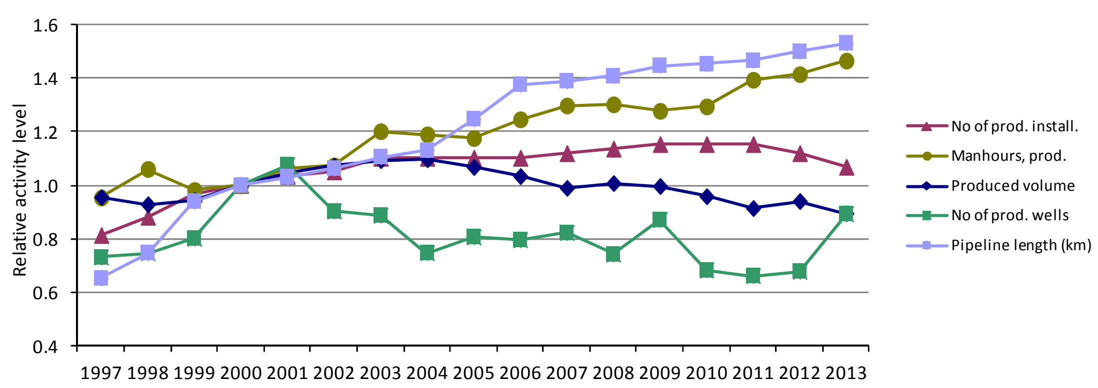

Figure 1 Trend in activity level, production

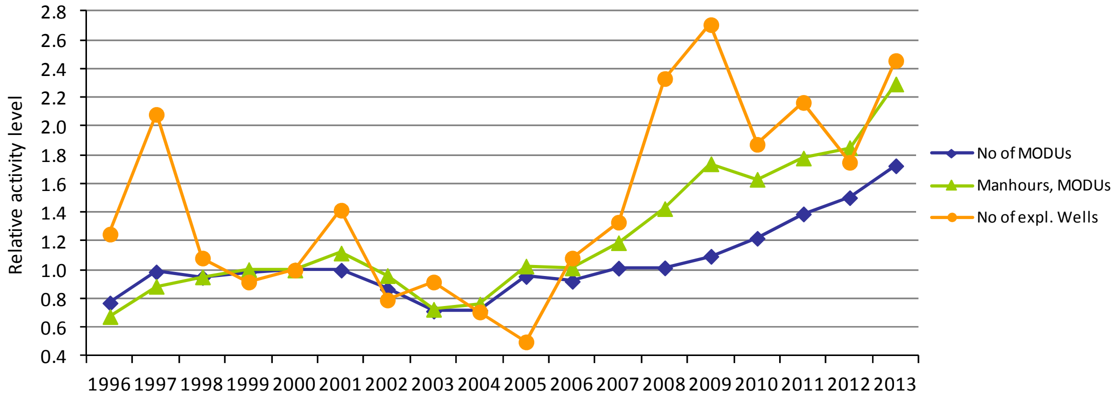

Figure 2 Trend in activity level, exploration

A corresponding activity overview for helicopter transport is shown in sub-chapter 0.

3.4 Documentation

Analyses, assessments and results are documented as follows:

- Summary report – the Norwegian Continental Shelf for the year 2013 (Norwegian and English versions)
- Main report – the Norwegian Continental Shelf for the year 2013
- Report for onshore facilities for the year 2013
- Report for acute spills to sea for the Norwegian Continental Shelf 2013, to be published in the autumn of 2014
- Methodological report, 2013

The reports can be downloaded free of charge from the Petroleum Safety Authority Norway's website (www.ptil.no/rnnp).

4. Scope

This social science analysis consists of the questionnaire-based survey which is carried out every other year and, in 2013, a report on causal factors and measures associated with structural integrity related incidents.

The methods for statistical analyses have been maintained from previous years, with only minor changes.

5. The questionnaire-based survey

A questionnaire-based survey was conducted of all personnel who were offshore in the period 14 October to 20 November 2013. At an overarching level, the object of the questionnaire-based survey is to acquire knowledge about employees' perception of the state of HSE in Norwegian petroleum activities. This is the seventh time that such a survey has been conducted on the NCS. The first occasion was in 2001, since when it has been conducted every other year. In parallel with this survey, a similar survey was carried out of petroleum facilities onshore. The results from the onshore facilities are presented in a separate report.

The questionnaire covered the following topics: demographics, the HSE climate, experience of accident risk, recreation conditions, working environment, ability to work, health, sickness absence, sleep, rest, and working hours.

A total of 7,924 people completed the questionnaire. The response rate for this year's survey was 29.5% for mobile facilities and 26% for production facilities. For the NCS as a whole, the response rate was 27.3%. The response rate is calculated on the basis of the number of working hours which the companies have reported to the PSA. Although this is a relatively low response rate, the number of replies is nonetheless sufficiently large to permit statistical analyses and to break down the data into different groupings. In order to assess whether the sample is representative of the population, the demographic characteristics of the sample may be examined. There was no major change in the demographic characteristics from 2011 to 2013. The composition also corresponds well with the breakdown of reported hours on production and mobile facilities, and with the breakdown into contractors' and operators' employees. As in previous years, there is a relative preponderance of survey responses from employees with managerial responsibilities.

5.1 HSE climate

In general, the results show an improvement in many HSE-related areas. The average scores for HSE climate (both positive and negative formulations) have improved. At the same time, it is apparent that there are still challenges in the same areas as in previous years. The list below shows the statements that were assessed most negatively from an HSE perspective.

- Different installations have different procedures and routines for the same circumstances, and this constitutes a threat to safety (35.4% agree fully or in part).
- Deficient maintenance has led to poorer safety (37.9% agree fully or in part).
- Hazardous situations have arisen because not everyone speaks the same language (35.5% agree fully or in part).
- I find it easy to consult governing documents (requirements and procedures) (28.6% disagree fully or in part).
- Reports on accidents or hazardous situations are often “sanitised” (25.2% agree fully or in part).
- In practice, production concerns take precedence over HSE concerns (22.9% agree fully or in part).
- Increased cooperation between facilities and shore through the use of IT systems has led to less safe operations (15.8% agree fuly or in part).
- Inadequate cooperation between operators and contractors often leads to hazardous situations (13.6% agree fully or in part).

5.2 Perceived accident risk

Overall, the perceived accident risk is unchanged compared with 2011. But in some areas, the employees perceive higher risks than in 2011. This applies to risks associated with helicopter accidents, sabotage/terror and failures in load-bearing structures or loss of buoyancy. The areas which the employees perceive as having the highest associated risks are falling objects, gas leaks and serious occupational accidents.

5.3 Working environment

The physical, chemical and ergonomic working environment does not appear to have changed to a notable degree compared with 2011. Where there are significant changes, they are for the better. It is worth noting that the areas which were highlighted as difficult ergonomic factors in 2011, such as working in a crouching position, working with the hands above shoulder height, sedentary work, and lifting with the upper body twisted or bent over, are still perceived as difficult areas. Well over one third of employees respond that they are exposed to high noise levels, which is also unchanged from 2011. There are however positive significant changes associated with skin contact with, for example, oil or chemicals and chemical odours and airborne dust.

In terms of the psycho-social working environment, the results show significant improvements, especially as concerns support, assistance and feedback from managers. The vast majority of employees also find that they can get help and support from their colleagues when needed. As in 2011, around one quarter find that it is necessary to work at a high tempo. At the same time, the experience of most is that they can determine their work pace themselves, and few find that they have so many tasks that it is difficult to concentrate on each individual task.

5.4 Leisure

The employees are generally satisfied with most of the circumstances relating to rest and recreation offshore.

5.5 Health and sickness absence

Most of those who responded to the survey assessed their own health and ability to work in relation to mental and physical requirements as good or very good. The same was true in the previous survey, but their responses in 2013 are even slightly better than in 2011. At the same time, it is apparent that many of the employees have one or more health complaints to one degree or another. As in previous years, the commonest reports of health complaints are of pains in the neck, shoulders, arms, back, knees and hips, and impaired hearing. There were no major changes in sickness absence from 2011 to 2013. The proportion of employees who suffered injuries increased from 2011, but the proportion of these that were lost time injuries fell compared with the same year.

5.6 Comparison of HSE assessments offshore and onshore

Employees onshore and offshore assess the HSE climate as positive overall. But where in the offshore results it is apparent that the assessment has improved in several areas, among onshore facilities several places have experienced a change for the worse. Many of the same HSE areas are perceived as challenging both offshore and onshore, notably the statements concerning procedures and governing documents, deficient maintenance and linguistic challenges. Overall, the experience of accident risk offshore is unchanged in relation to 2011. Onshore, the employees experience the accident risk as greater in 2013 than in 2011.

It is consistently the case that, although the results overall show fairly positive assessments of the HSE climate, working environment and employee health, the trend at the onshore facilities is more negative than it is offshore. Offshore, the assessments are consistently improved or unchanged whereas onshore, a good number of areas have deteriorated. It is possible that the sample may partially explain the differences in trends onshore and offshore. The characteristics of the respondents in the sample indicate that the proportion with managerial responsibilities is higher offshore than onshore.

6. Causes and measures associated with structural and maritime incidents

In 2013, the Petroleum Safety Authority Norway instigated a study on the causes of structural and maritime incidents.[2] The background for the study was the negative trend in reported structural and maritime incidents on the NCS in the last three years, as well as the serious incidents on Floatel Superior and Scarabeo 8 in 2012. The study is focused on incidents which might lead to major accidents. The objectives may be summarised as follows:

- To collect data from literature, investigations, interviews and questionnaires concerning causes and measures associated with structural and maritime incidents.
- To perform a complete assessment and analysis of human, technical and organisational causes and underlying factors.
- On the basis of identified causes, to suggest areas for improvement and concrete measures which the industry should address.

Technical experts from operating companies, engineering companies, shipowners, other key suppliers and research institutions provided information for the study. Viewed in the light of the major accident potential, the study shows that the focus on structural and maritime incidents and the disciplines involved is inadequate. The investigations of maritime incidents are of variable, at times poor, quality, while few structural incidents are investigated at all. Overall, the investigations contribute less than is desirable to a better understanding of underlying causes and to a basis for sound risk-reducing measures. Furthermore, the industrys own experts find that the status of the structural engineering profession has been diminished and that more attention needs to be focused on maritime systems and operations. Based on the results of this study, four main challenges were identified, with the following recommendations:

6.1 Increase the quality and quantity of investigations of structural and maritime incidents

One of the study's main findings is linked to the inadequate quality and quantity of investigations.

- Operating companies and shipowners should assess whether more structural incidents could be investigated. The criteria for when such investigations are undertaken should be reviewed, and an assessment made of which investigation methodology is best suited to yielding a better understanding of construction-related incidents.

- Measures should be undertaken to raise the quality of investigations for mobile facilities so that both directly triggering and underlying causes of the incidents are detected. Consideration may for example be given to establishing a shared pool of investigative resources which small and medium-sized shipowners could make use of. This could contribute to raising the expertise of all participants over time and may also improve the quality and utility of investigations from different companies.

6.2 Improve information exchange between participants and between different phases

The study has revealed a need to strengthen information exchange between participants and between different phases of a facility's life cycle. Efforts must be made towards improved information exchange between engineering companies and operating/shipowners through, for example, detailing how conceptual choices and technical solutions work in the field, or through strengthened practice in using data from

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[2] Criteria for reporting construction and maritime incidents in RNNP are described in PSA (2012) "Methodological report – weighting of incidents relating to constructions and maritime systems (DFU 8) in RNNP" at www.ptil.no – Only in Norwegian.

decommissioned facilities as a source of empirical knowledge. Good information exchange between participants and phases also requires that there are adequate resources for performing good follow-up work in the design and fabrication phase.

- New forums should be created, or existing ones strengthened, for discussion and interaction between the participants in the structural engineering profession.

- More systematic transfer of experience from operators and shipowners to the engineering companies should be established. This will contribute to learning processes within engineering companies and better structural solutions, both conceptually and at detailed design level. For example, the engineering companies need to be provided with information on how inspection work is carried out in practice (using which methodologies and measuring points), the communication of findings from investigation reports and the communication of operational experiences.

- There is a need for an improved follow-up of engineering companies and yards from clients. When contracts are awarded to engineering companies and yards that have little or no experience from the NCS, it is recommended to reinforce the follow-up of structural safety and marine systems.

- Opinions in the industry are divided on whether improved analytical tools produce more or less robust structures. It is recommended that the concept of robustness is clarified in the regulations and industry standards. It is in any case crucial to maintain engineering expertise in order to safeguard the understanding of the potential and limitations of the analytical tools.

6.3 Improve knowledge and practice associated with marine systems

There is a need for improved knowledge and practice in terms of marinesystems. Such improvement will ensure that marine systems receive the necessary attention and that the risk of maritime incidents will be reduced or handled better.

- Studies should be conducted to acquire better knowledge of the actual loads on anchoring systems.
- Maintenance of anchoring systems, especially on older mobile facilities, must be improved in order to reduce the number of uncontrolled deployments.
- On the basis of anchoring analyses, it must be ensured that adequate anchor line capacity is selected, especially on large semi-submersible mobile facilities.
- Screens and equipment for controlling ballast systems on floating rigs should be improved and designed in accordance with recognised standards and guidelines for control-room equipment.
- The competence of stability system operators is a critical issue and the quality of training in Norway should be improved. In addition, their familiarity with facility-specific equipment and personnel must be secured. Furthermore, assessment should be given to designing and implementing training based on methods which emphasise team training, scenario-based training and simulator training.

6.4 Need for more systematic safety work and prevention of major accidents linked to both structural and maritime incidents

For structural integrity related incidents, the study has identified that the structural engineering profession is under pressure. For structural integrity related incidents, there is a need to ensure that assessments from the structural engineering profession have higher focus in the organisations, so that dilemmas between, for example, costs and design choices are resolved appropriately and prudently and so that any tendency to drift into failure[3] is detected and corrected.

[3] Safety researcher Sidney Dekker (2011) employs the expression "drift into failure". This concerns slow development trends which escape attention because they progress so slowly that people are habituated to the small changes without perceiving

that, over time, these can entail large changes which negatively impact the risk profile. Dekker stresses the importance of detecting, understanding and correcting such negative processes in time in order to avoid major accidents.

7. Status and trends - DFU12, helicopter incidents

The cooperation with the Civil Aviation Authority and the helicopter operators was continued in 2013. Aviation data obtained from helicopter operators involved includes incident type, risk class, seriousness, type of flight, phase, helicopter type and information about departure and arrival. The main report (PSA, 2013a) contains additional information about the scope, constraints and definitions. The last major accident to result in fatalities on the NCS was in September 1997 in connection with the helicopter accident outside Brønnøysund.

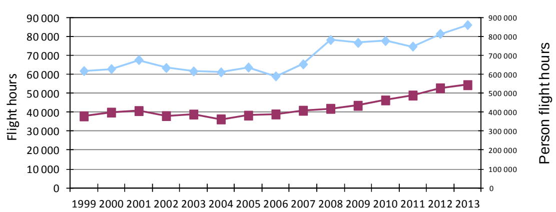
In 2012, there were two emergency landings on the sea in the UK sector, and one controlled emergency landing on a facility in the Norwegian sector. All of these occurred with the EC225 Super Puma helicopter type. With support from the helicopter companies and the oil companies, for a period the Civil Aviation Authority implemented restrictions on the use of this helicopter type. Following modifications and the introduction of a monitoring programme, the EC225 fleet is again being used for the transport service and shuttle traffic.

The activity indicators express how the exposure to helicopter risk is developing, and are thus a more leading indicator. The indicators are explained in detail in the main report.

7.1 Activity indicators

Figure 3 shows activity indicator 1 (transport service) and activity indicator 2 (shuttle traffic) as the number of flight hours and number of person flight hours per year in the period 1999-2013. For the transport service, there has been an increase in recent years. There has been a small reduction in the volume of shuttle traffic for the period as a whole, but the marked increase in person flight hours in 2012 fell back close to the 2011 level in 2013.

TRANSPORT SERVICE



SHUTTLE TRAFFIC

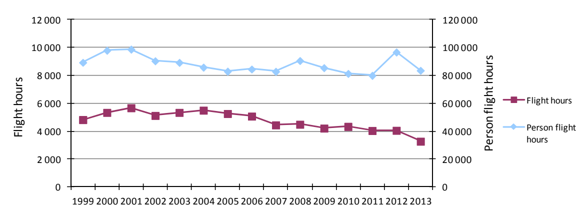


Figure 3 Volume of transport service and shuttle traffic, person flight hours and flight hours, 1999-2013

Activity indicator 1, the transport service volume per year, must be seen in the context of the activity level on the NCS. The number of working hours on production facilities has been increasing slightly, whereas the number of working hours on mobile facilities has varied somewhat, but with a general increase since 2003. Fundamentally, there is a constant need for transport per working hour, which implies an increase in both flight hours and person flight hours. This is offset by better utilisation of the helicopters, and the new helicopters' ability to take off with the maximum number of passengers under virtually all weather conditions.

On several facilities, shuttling is part of everyday life. Most shuttling takes place on the Ekofisk field. To a certain degree, shuttling now takes place using larger helicopters than before. This may, to some extent, explain the general fall in the number of flight hours. The increase in the volume of person flight hours in 2012 (20.9%) can be viewed in the context of carrying out a major maintenance programme which has necessitated more shuttling between the facilities. In 2013, the number of flight hours in shuttle traffic fell relative to 2012 (by some 19.2%), as did the number of person flight hours (by some 13.6%).

7.2 Incident indicators

7.2.1 Incident indicator 1 – serious near-misses

Figure 4 shows the number of incidents included in Incident indicator 1. From 2009 (and subsequently for 2006, 2007 and 2008), the most serious near-misses which the company reported were therefore reviewed by an expert group consisting of operational and technical personnel from the helicopter operators, from the oil companies and from the PSA's project group in order to classify the incidents on a finer scale, based on 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.

Incident indicator 1 includes the events with little or medium remaining margin against fatal accidents for passengers, i.e. no or one remaining barrier. In the years 2006 and 2007, there was one incident in each year with no remaining barriers, while there were two such incidents in 2008. There have been no incidents without remaining barriers against fatal accidents in the years 2009 to 2013. As previously, incidents during the parked phase onshore are not included.

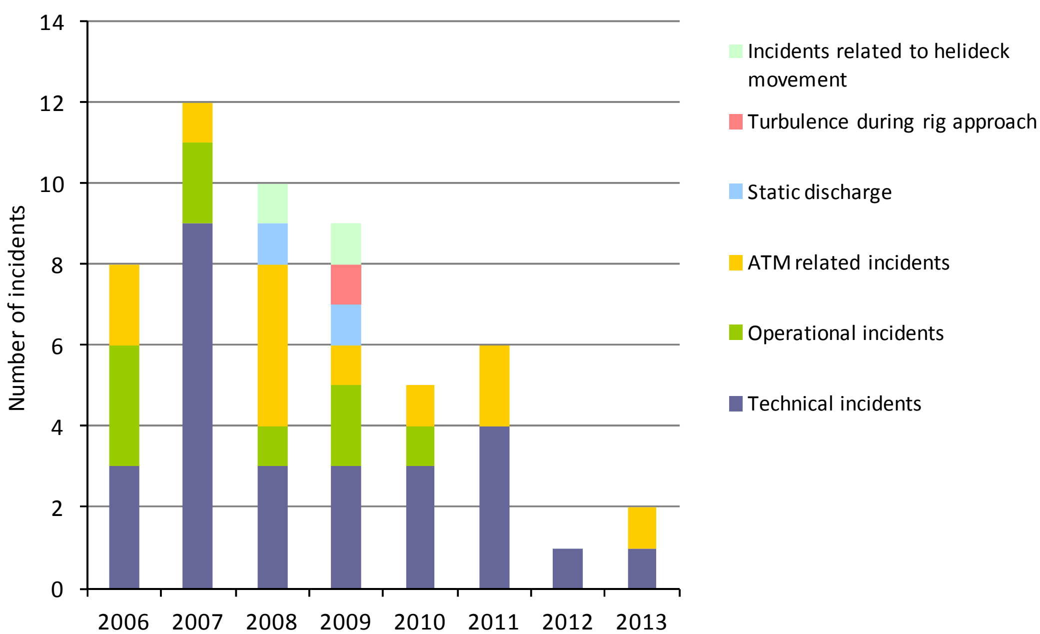


Figure 4 Incident indicator 1, incidents with little or medium remaining safety margin, 2006-2013

The one incident in 2013 relates to a controlled emergency landing by a Sikorsky S92 on an installation due to a technical problem with the main rotor. The other incident in 2013 has been registered as an ATM incident. This relates to an evasive manoeuvre due to a weather balloon. The incident has been assessed conservatively since it is not known what damage the weather balloon could have caused. Both the incidents were assessed as having one barrier remaining.

7.2.2 Incident indicators linked to causal categories.

As of 2009, incident indicator 3 has been replaced by three incident indicators based on causal categories, with the following content:

- Incident indicator 3:
  Helideck factors:
  - Incorrect information about position of helideck
  - Incorrect/missing information
  - Equipment failure
  - Turbulence
  - Obstacles in approach/departure sectors or on deck
  - Persons in restricted sector
  - Breach of procedures
- Incident indicator 4:
  ATM aspects (air traffic management)
- Incident indicator 5:
  Bird strikes.

All degrees of severity beyond "no impact on safety" are included in these indicators. Data for 2008–2013 are presented in Figure 5–Figure 7. There was a strong reduction for helideck factors in 2010 compared with 2009. The number of incidents in the indicator has varied around this level in subsequent years. In 2013, helideck incidents comprised nearly 20% of the total number of incidents without a safety impact. In 2013, as previously, the majority of incidents relate to floating facilities. There may appear to be a clear improvement in follow-up of procedures and routines on fixed facilities, which most likely reflects the industry's focus on such factors. On the other side, ATM incidents increased in 2009, 2010 and 2011, while the indicator shows a strong fall in 2012-2013 relative to 2011. This is assumed in part to be related to ongoing projects to increase ATM availability on the NCS. The absolute largest individual contributor to incidents with a safety impact is technical factors. This cause is not reflected in a separate indicator, but in 2013 accounts for more than 45% of the total number of reported incidents with a safety impact.

Based on these causal indicators, the main report (PSA, 2013a) has indicated areas and aspects where improvements should be prioritised. The following new improvement proposals have been identified:

- The Cooperation Forum for Helicopter Safety and the petroleum operators are recommended to intensify their efforts to influence rig owners to comply with the procedures in the helideck manual. These factors were commented on pursuant to the 2011 RNNP report (recommendation 7).
- The helicopter companies and oil and gas operators are recommended to focus more on technical incidents and troubleshooting, and evaluate which measures may be implemented in order improve safety in this area.

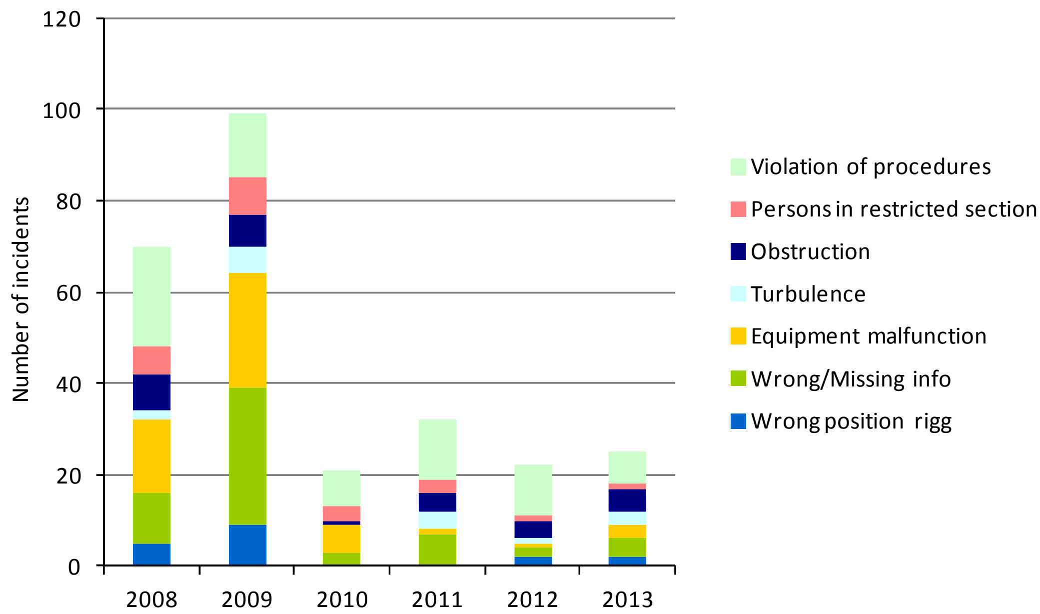


Figure 5 Helideck factors, 2008–2013

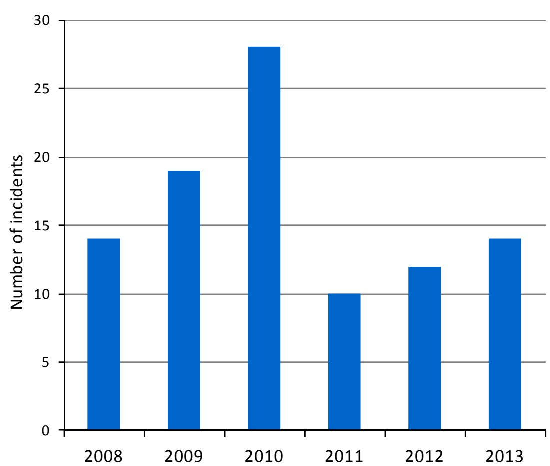


Figure 6 ATM aspects, 2008–2013

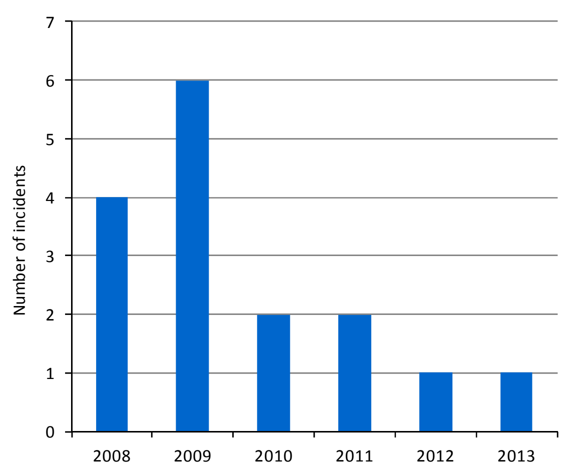


Figure 7 Bird strikes, 2008–2013

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

The indicators for major accident risk from previous years have been continued, with a primary emphasis on indicators for incidents and near-misses with the potential for causing a major accident. Indicators for major accident risk involving helicopters are discussed in Chapter 5, and barriers against major accidents in Chapter 9.

There have been no major accidents, per the definition used in the report, on facilities on the NCS since 1990. None of the DFUs that indicate major accident risk on facilities have resulted in fatalities in the period. The last time there were any fatalities in connection with one of these major accident DFUs was in 1985, with a shallow gas blowout on the "West Vanguard" mobile facility; see also page 11 in connection with the helicopter accident outside Brønnøysund in 1997. Neither have there been any ignited hydrocarbon leaks from process systems since 1992, apart from the occasional minor leak which is not considered to have the potential for resulting in major accidents.

The most important individual indicators for production and mobile facilities are discussed in sub-chapter 8.2. The other DFUs are discussed in the main report. The indicator for total risk is discussed in sub-chapter 8.3.

8.1 DFUs associated with major accident risk

Figure 8 shows the trend in the number of reported DFUs in the period 2003–2013. It is important to emphasise that these DFUs contribute very differently to risk. The clearly rising trend during the period 1996-2000 has been discussed in previous years' reports and has therefore been omitted from the figure. After 2002, there was a reduction in the number of incidents up to 2007. After 2007, we observe minor variations around a stable level of some 70 incidents per year. In 2012, there was a marked reduction which continued in 2013. In 2013, the number of incidents is at its lowest in the last 10 years, and the level is significantly lower than the average for the period 2007-2012.

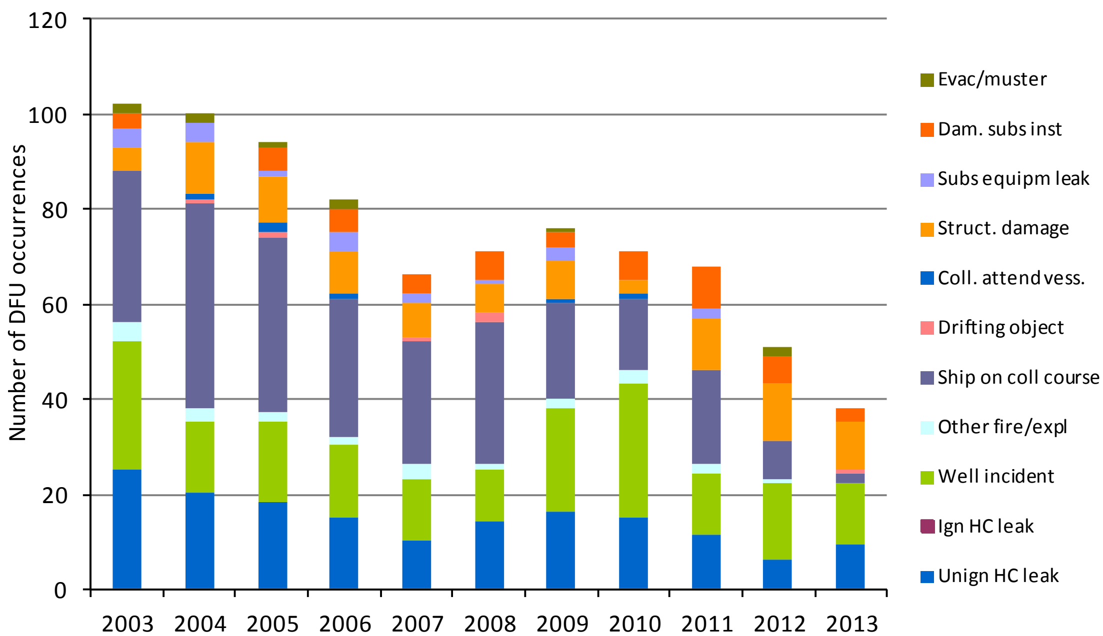


Figure 8 Reported DFUs (1-11) by categories

8.2 Risk indicators for major accidents

8.2.1 Hydrocarbon leak in the process area

Figure 9 shows the number of hydrocarbon leaks greater than 0.1 kg/s in the period 2001–2013. There was a clear fall in the number of hydrocarbon leaks from 2002 to 2007. The number of leaks above 1 kg/s was fairly stable in the same period. In 2013, one leak was recorded in the category 1-10 kg/s and eight in the category 0.1-1 kg/s. There has therefore been a 50% increase in the number of leaks compared with 2012.

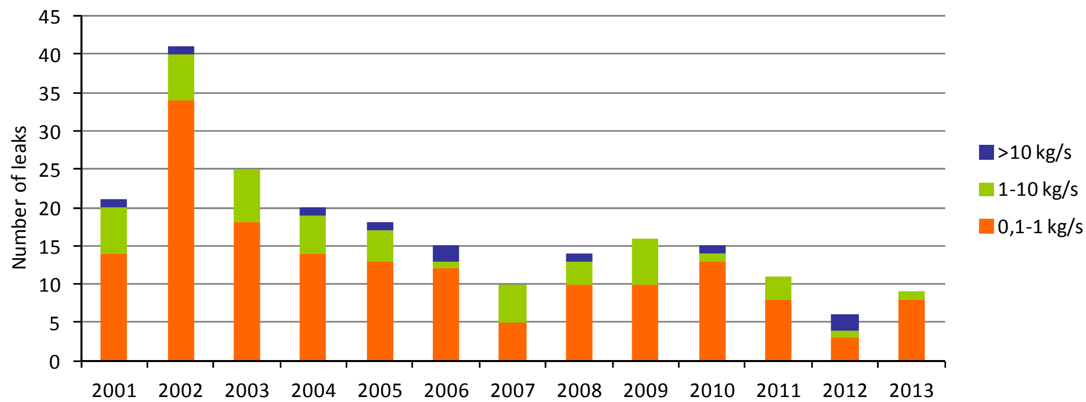


Figure 9 Number of hydrocarbon leaks exceeding 0.1 kg/s, 1996-2013

Figure 10 shows the number of leaks when these are weighted according to the risk contribution they are assessed as making. In simple terms, one can say that the risk contribution of each leak is roughly proportional to the leak rate expressed in kg/s. Since, with one exception, the leaks in 2013 were all in the smallest leak category, the overall contribution is relatively low. It is especially so compared with 2012, when two large leaks made the risk contribution the third-highest recorded in the period.

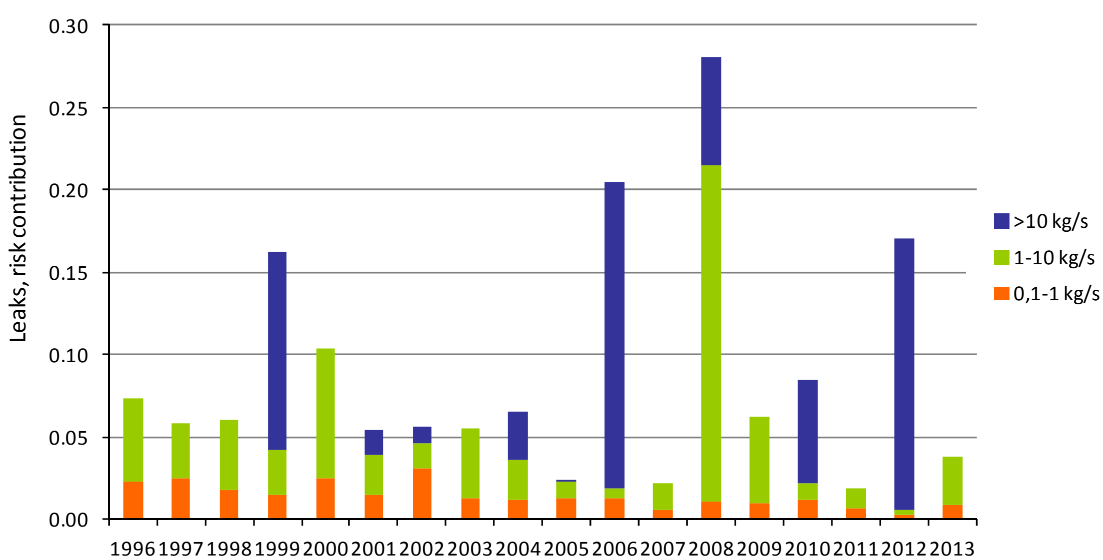


Figure 10 Number of hydrocarbon leaks exceeding 0.1 kg/s, 1996-2013, weighted according to risk potential

Figure 11 shows the trend in leaks exceeding 0.1 kg/s, normalised against facility years, for all manned production facilities. The figure illustrates the technique used throughout to assess the statistical significance (validity) of trends. Figure 11 shows that the reduction in the number of leaks per facility year is right on the threshold of being statistically significant in 2013 relative to the average for the period 2003–2013. This is indicated by the height of the column for 2013 being immediately above the middle grey shaded area in the column on the far right in the figure ("Int 03-12", see also sub-chapter 2.3.5 in the pilot project report). The number of leaks has been normalised both against working hours and against the number of facilities in the main report.

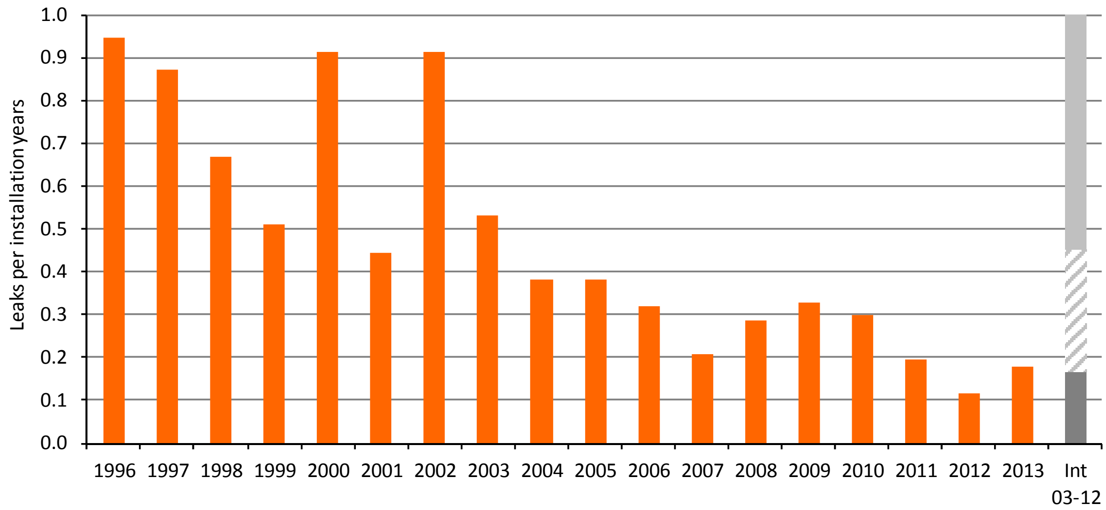


Figure 11 Trend, leaks, normalised against facility years, manned production facilities

There is considerable variation between operators in terms of the frequency of leaks exceeding 0.1 kg/s. These differences have been nearly constant over many years, which shows that there is clearly still a potential for improvement. This is also underscored in Figure 12, which shows the average leak frequency per facility year for the operating companies on the NCS. The figure shows data from the last five years.

When the average leak frequency is charted for each individual facility, the four facilities with the highest average frequency during the period 2009-2013 – all with the same operating company – together account for more than 25% of the number of leaks on the NCS during this period. Two of the five facilities with the highest average frequency have been among the top five in equivalent overviews in RNNP reports since 2005.

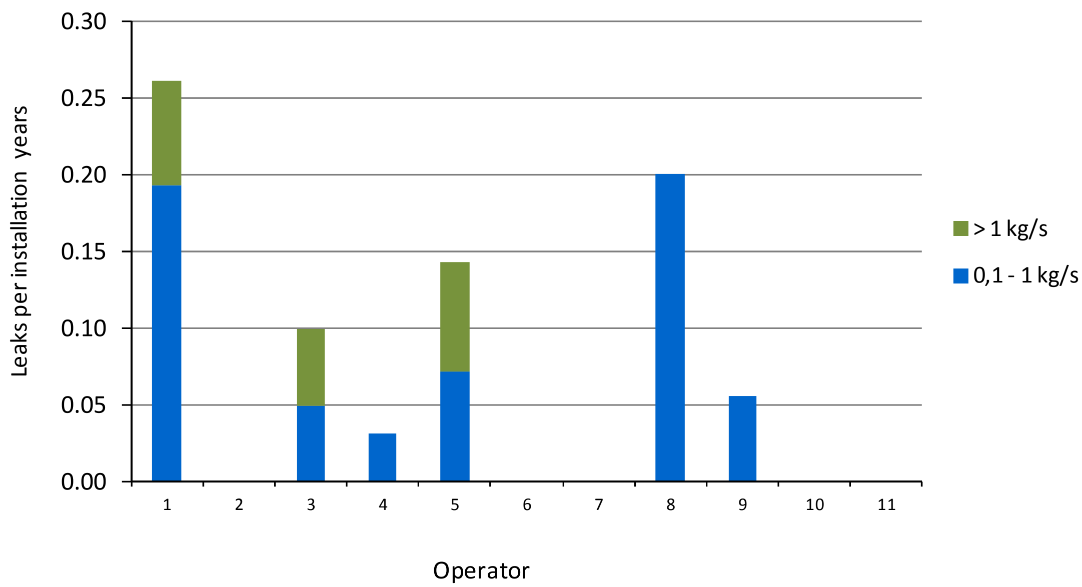


Figure 12 Average leak frequency per facility year, 2009–2013

A systematic comparison has been made for gas, condensate and oil leaks on the UK and Norwegian Continental Shelves for the areas north of Sleipner (59°N), where the facilities on both shelves are of somewhat similar scope and complexity. It must be pointed out that the reporting period for the UK Continental Shelf runs until 31 March each year. The most recent available period is 1 April 2012 - 31 March 2013 (called "2012"), which has been compared with 2012 on the Norwegian Continental Shelf.

Figure 13 shows a comparison between the Norwegian and UK shelves, including gas/two-phase leaks and oil leaks, normalised against facility year, for the two countries' shelves north of 59°N. The figure applies to the period 2000-2012. Data for oil leaks included in the figure are restricted to process equipment. As mentioned in previous years' reports, some oil leaks that are not associated with process equipment have been omitted from the figure.

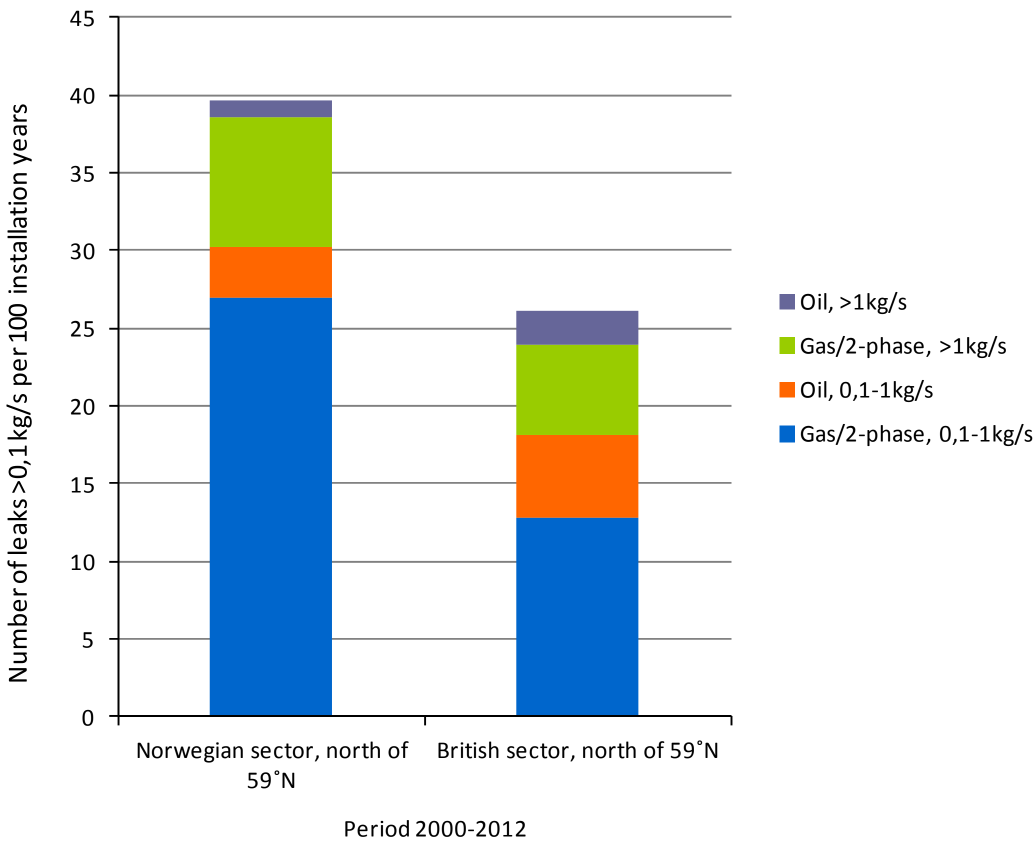


Figure 13 Comparison of gas/two-phase and oil leaks on the Norwegian and UK Continental Shelves north of 59°N per 100 facility years, average 2000-2012

The number of leaks on the NCS has declined substantially in recent years, so the chosen period has a certain significance. For example, the data indicate the following observations as regards average leak frequency per facility year for all leaks exceeding 0.1 kg/s:

- The 2000-2012 period: Norwegian Continental Shelf 52% higher than the UK Continental Shelf.
- The 2008-2012 period: Norwegian Continental Shelf 14% higher than the UK Continental Shelf.

A significance test has been performed for the difference between the number of leaks exceeding 0.1 kg/s on the Norwegian and UK shelves for the period 2008-2012. There is no significant difference between the areas.

On the Norwegian Continental Shelf, no ignited hydrocarbon leaks (greater than 0.1 kg/s) have been recorded since 1992. The number of hydrocarbon leaks greater than 0.1 kg/s since 1992 is probably around 460. It has been shown that the number of ignited leaks is significantly lower than on the UK Continental Shelf, where about 1.5% of the gas and two-phase leaks since 1992 have been ignited.

8.2.2 Loss of well control, blowout potential, well integrity

Figure 14 shows the occurrence of well incidents broken down by exploration drilling and production drilling, normalised per 100 drilled wells. Both exploration drilling and production drilling are shown together and on the same scale for comparison.

For exploration drilling, there have been substantial variations throughout the period, perhaps around a stable average on a par with 1996. There was a considerable reduction during the period 2005-2008 and significant variation during 2009-2013. The level during this period appears to represent a break in the positive trend during 2005-2009. Incidents during production drilling saw a continuously rising trend until 2003, with minor variations. During the period from 2004 to 2008, there was a fall, and then an increase in 2009 and 2010. Since 2010 there has been a declining trend for production drilling. The fall in 2013 is statistically significant compared with the average of the preceding period. Most well incidents are in the regular category, i.e. incidents with minor potential.

EXPLORATION DRILLING PRODUCTION DRILLING

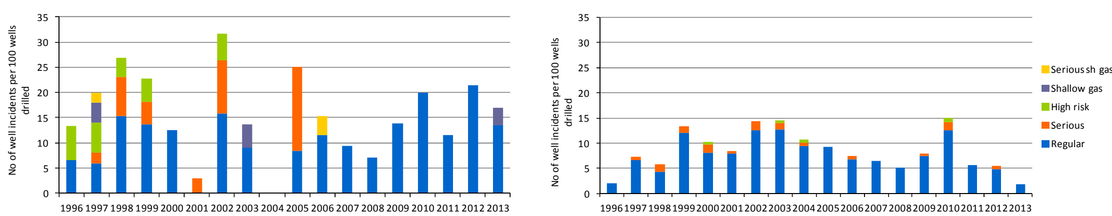


Figure 14 Well incidents by severity per 100 wells drilled, for exploration and production drilling

Figure 15 shows an overview of all well control incidents (for exploration and production wells) in relation to the areas on the NCS where the well control incidents have occurred. The area divisions correspond to the same divisions used on the Norwegian Petroleum Directorate's shelf map.

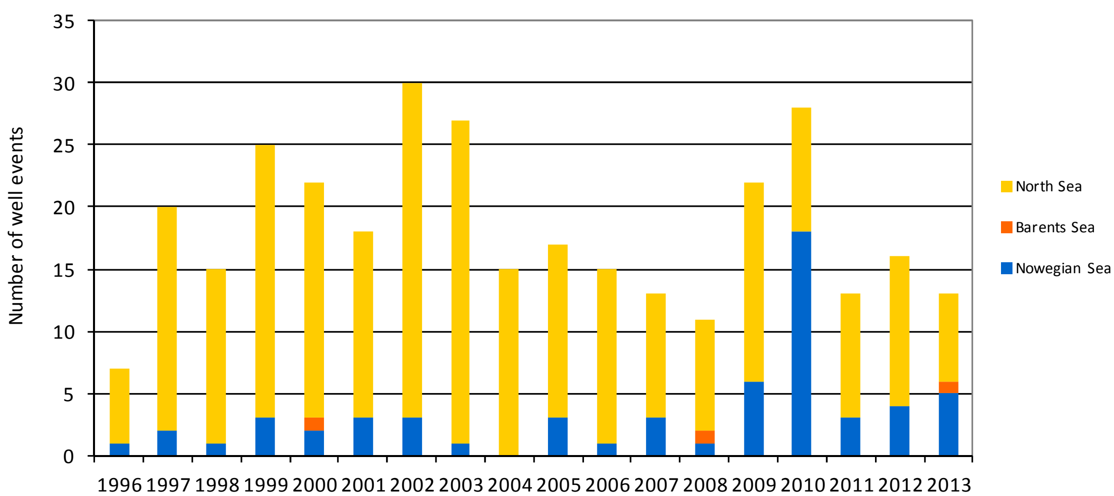


Figure 15 Distribution of well control incidents by areas, 1996-2012

The Well Integrity Forum (WIF) established a pilot project for performance indicators (KPIs) for well integrity in 2007. A total of 15 operating companies have reviewed all their "active" wells on the NCS, a total of 1,866 wells, with the exception of exploration wells and permanently plugged wells. This was first reported in accordance with WIF's list of well categories in 2008, based on current definitions and subgroups per category. WIF uses the following well categories;

Red: one barrier failed and the other is degraded/not verified or with external leaks
Orange; one barrier failed and the other is intact, or a single failure could cause a leak to surroundings
Yellow: one barrier leaks within the acceptance criteria or the barrier has been degraded, the other is intact
Green; intact well, no or insignificant integrity aspects.

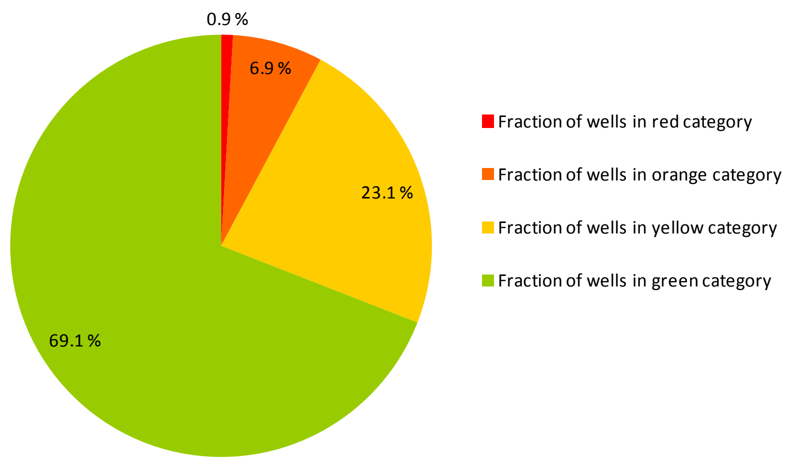


Figure 16 Well categories - red, orange, yellow and green, 2013

The mapping shows an overview of well categories distributed according to the percentage of the total sample of 1,866 wells.

The results show that 7.8% of the wells have reduced quality compared with the requirement for two barriers (red + orange category). 23.1% of the wells are in the yellow category. This includes wells with reduced quality compared with the requirement for two barriers, but the companies have compensated for this through various measures such that they are deemed to comply with the requirement for two barriers. The rest of the wells, i.e. 69.1%, are in the green category. These are deemed to be in full compliance with the requirement for two barriers.

There has been an increase in the percentage of wells in the top three categories from 24% to 31% (154 more wells than in 2009). The development in the different categories is shown in Figure 17.

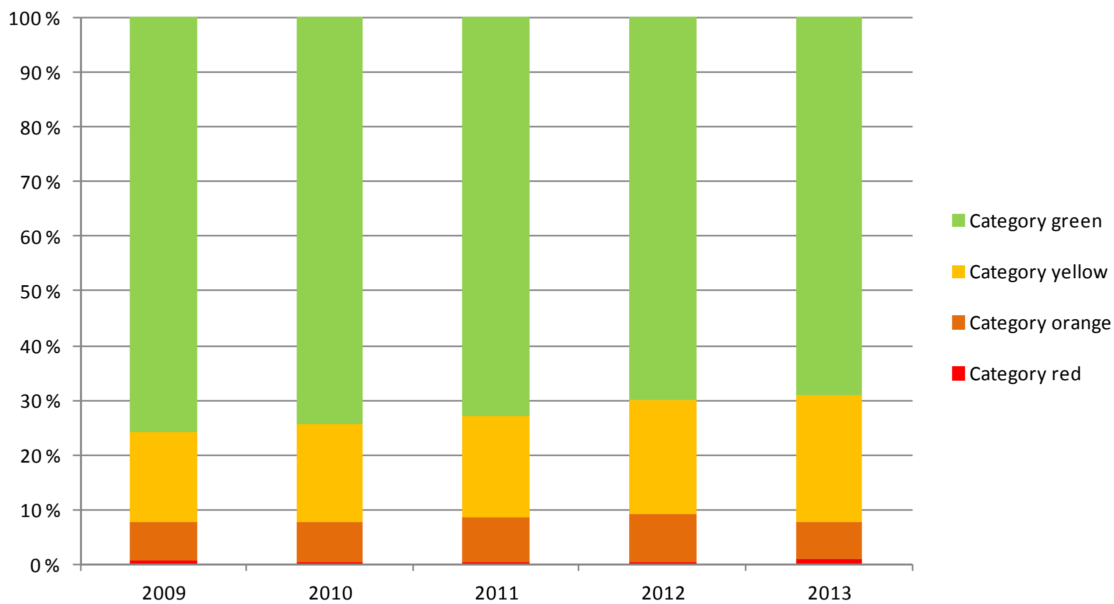


Figure 17 Development in well categories, 2009-2013

8.2.3 Leak/damage to risers, pipelines and subsea facilities

No leaks from risers to manned facilities were reported in 2013. Nor were any leaks from pipelines reported in 2013. In the previous year, two leaks from flexible risers to manned facilities were reported.

In 2013, three incidents of serious damage to risers and pipelines within the safety zone were reported.

Serious damage is also included in the calculation of the overall indicator, but with lower weight than for leaks. Figure 18 shows an overview of the most serious incidents of damage during the period 1996-2013.

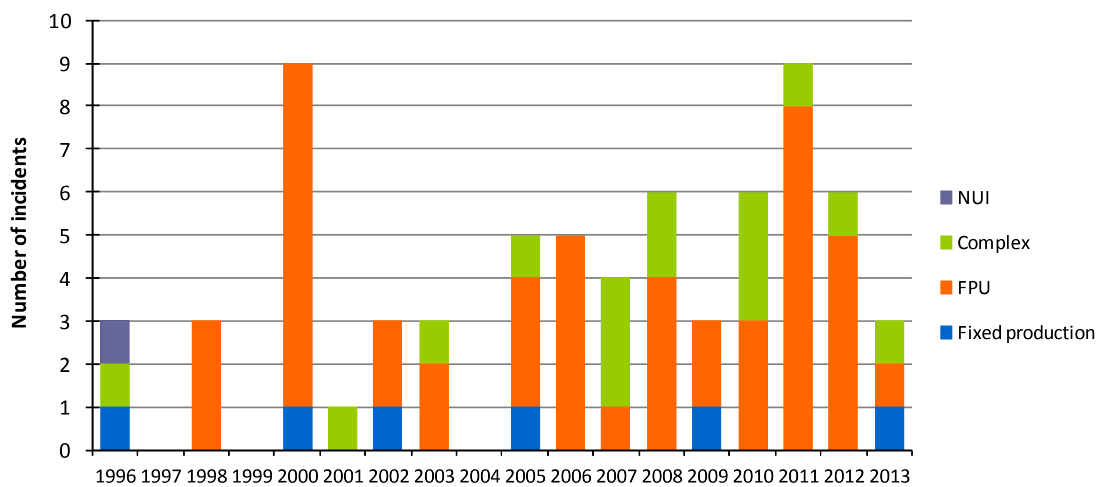


Figure 18 Number of incidents involving serious damage to risers & pipelines within the safety zone, 1996-2013

8.2.4 Ships on collision courses, structural damage

There are only a few production facilities and just a few more mobile facilities where the facility itself or the standby vessel are responsible for monitoring passing ships on a potential collision course. The others are monitored from the traffic centres at Ekofisk and Sandsli.

For ten years, there has been an indicator for DFU5, where the number of ships reported on a potential collision course is normalised according to the number of facilities monitored from the traffic centre at Sandsli, expressed as the total number of monitoring days for all facilities monitored by Statoil Marine at Sandsli. The number of recorded instances of ships on a collision course has declined substantially in recent years.

As regards collisions between vessels associated with the petroleum activities and facilities on the NCS, there was an elevated level in 1999 and 2000 (15 incidents each year). Statoil in particular has worked hard to reduce such incidents, and in recent years, this figure has been around two to three per year.

There were three collision incidents in 2013: the supply vessel Skandi Nova allided with a protruding lifeboat cradle on the main deck of Eldfisk B; the research vessel Viking Lady hit a leg on Valhall Flanke Nord with observable damage to a ladder; Far Symphony twice impacted Maersk Innovator since they had problems regaining control of the vessel after an initial impact.

Major accidents associated with structures and maritime systems are rare. Even though there have been several very serious incidents in Norway, there are too few to gauge trends. Accordingly, selected incidents and damage of lesser severity have been selected as measures of changes in risk. It is also assumed that there is a connection between the number of minor incidents and the most serious; see the methodology report.

The current regulations set requirements for flotels and production facilities in terms of withstanding the loss of two anchor lines without serious consequences. Loss of more than one anchor line happens from time to time. This may have major consequences, but rarely as great as on *Ocean Vanguard* in 2004. Mobile drilling facilities are only required to withstand the loss of one anchor line without serious consequences.

Structural damage and incidents that have been included in RNNP are primarily classified as fatigue damage, but some are storm damage. As regards cracks, only continuous structural cracks are included. No clear connection has been demonstrated between the age of the facility and the number of cracks. The number of DFU8 incidents during the period 1996-2013 is shown in Figure 19.

A total of 10 incidents involving structural damage were registered in 2013, of which three were associated with anchor lines, one DP incident, three incidents involving water penetrating the hull and one incident involving cracks between two tanks (fatigue). None of the incidents in 2013 is categorised as especially serious. The high number of incidents in the period 2011-2012 appears to constitute a break in the positive trend observed for the period 2004-2010.

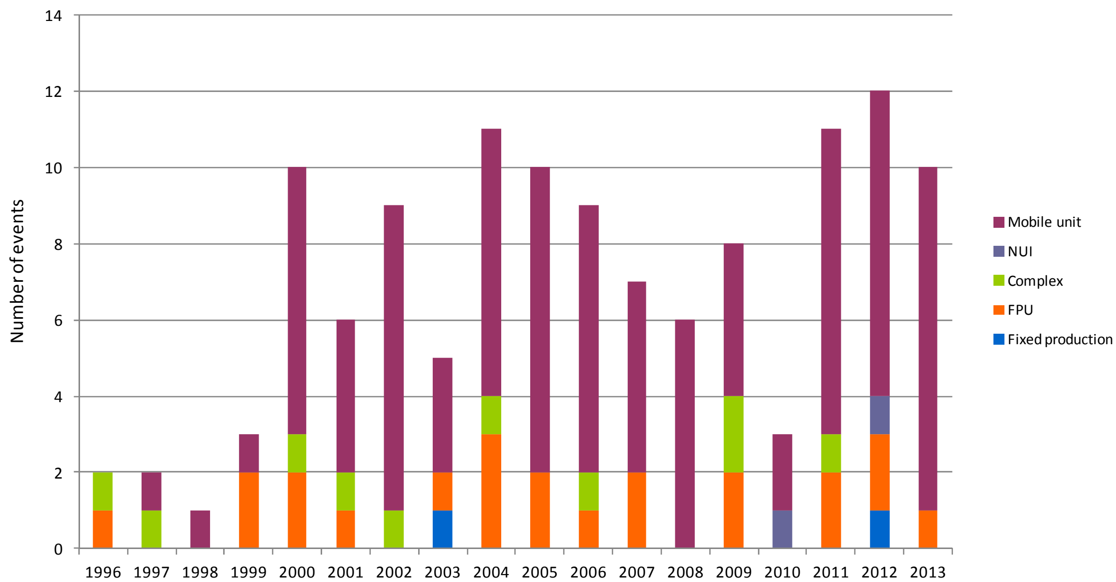


Figure 19 Number of serious incidents and incidents involving damage to structures and maritime systems which conform to the criteria for DFU8

8.3 Total indicator for major accidents

The total indicator applies to major accident risk on facilities, whereas risk associated with helicopter transport was discussed in Chapter 5. The calculation model assigns the DFU-related incidents a weighting based on the probability of a fatal accident if the incident develops. It is emphasised that this indicator is only a supplement to the individual indicators, and expresses the development in risk factors related to major accidents. In other words, the indicator expresses the effects of risk management.

The total indicator weights the contributions from the observations of the individual DFUs according to the potential for loss of life (see the pilot project report), and will therefore vary considerably, based on the observations of the individual DFUs. Figure 20 shows the indicator for production facilities with annual values, in addition to a three-year rolling average. The large variations from year to year are reduced when viewing the three-year rolling average, thereby clarifying the long-term trend. Working hours have been used as a common parameter for normalisation against the activity level. The level of the normalised value was set at 100 in the year 2000, which also applies to the value for the three-year rolling average.

For production facilities, looking at the three-year average, the main impression is of a relatively constant level until 2004. Since 2005, the level has been somewhat constant at a lower level and slightly declining. Individual incidents with considerable risk potential may cause large variations and have an effect over three years, due to the averaging, as the figure clearly shows for 2004 (the blowout at Snorre A) and 2010 (the well incident at Gullfaks C). In 2013, there were no very serious incidents and the total number of incidents is relatively low. The result is the lowest recorded relative risk indicator for the period 1998-2013.

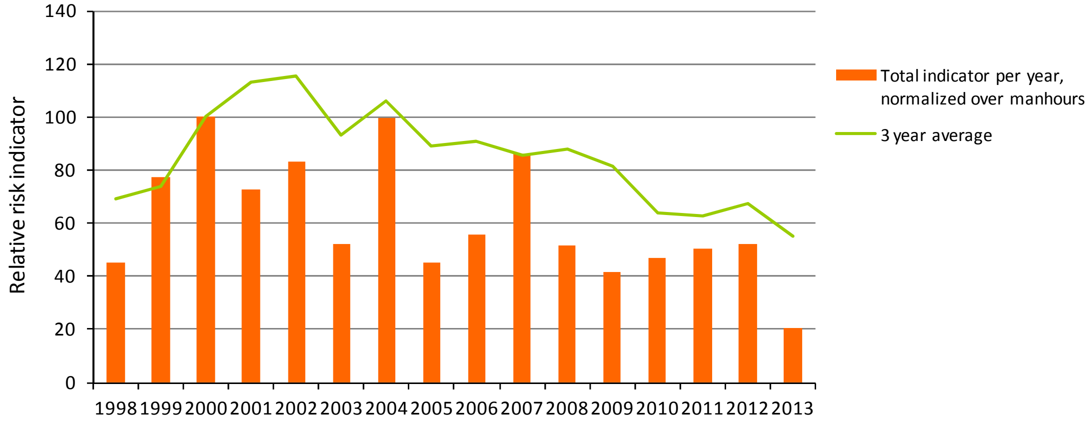


Figure 20 Total indicator, production facilities, normalised against working hours, annual values and three-year rolling average

Figure 21 shows the trend in the total indicator for mobile facilities with annual values and three-year rolling average. The variations are greater than for the production facilities. With the exception of 2012, the values in the period 2009-2013 are at a low level. In 2012, the increase was significant due primarily to structural and maritime related incidents.

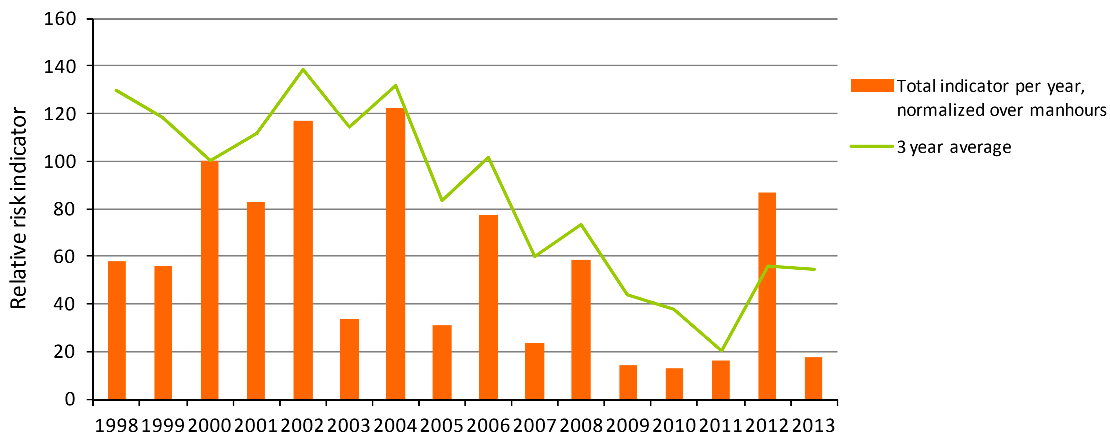


Figure 21 Total indicator, mobile facilities, normalised against working hours, annual values and three-year rolling average

9. Status and trends – barriers against major accidents

Reporting and analysis of data concerning barriers has been continued from preceding years without significant adjustments. As previously, the companies report test data from routine periodic testing of selected barrier elements.

9.1 Barriers in the production and process facilities

There is primary emphasis on barriers relating to leaks from the production and process facilities, including the following barrier functions:

- Integrity of hydrocarbon production and process facilities (covered to a considerable degree by the DFUs)
- Prevent ignition
- Reduce clouds/emissions
- Prevent escalation
- Prevent fatalities

The different barriers consist of several interacting barrier elements. For example, a leak must be detected before isolation of ignition sources and emergency shutdown (ESD) is implemented.

Figure 22 shows the proportion of failures for the barrier elements associated with production and processing and for which test data has been collected. The test data are based on reports from all production operators on the NCS.

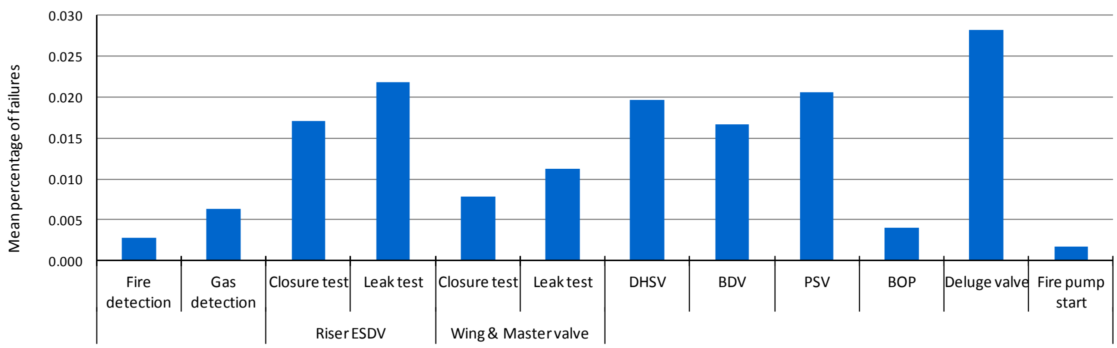


Figure 22 Mean percentage of failures for selected barrier elements, 2013

The main report shows the difference between the mean percentage of failures (Figure 22), i.e. the percentage of failures for each facility individually, averaged for all facilities, and the "overall percentage of failures", i.e. the sum of all failures on all reporting facilities, divided by the sum of all tests for all reporting facilities. All facilities have the same contribution to the mean percentage of failures, regardless of how many tests they have.

The data show considerable variations in average levels for each of the operating companies, and for several of the barrier elements. The variations are even greater when one looks at each individual facility, as has been done for all barrier elements in the main report. Figure 23 shows an example of such a comparison for testing emergency shutdown valves (ESDVs) on risers and flowlines. Each individual facility is assigned a letter code, and the figure shows the percentage of failures in 2013, the average percentage of failures during the period 2007-2013, as well as the total number of tests carried out in 2013 (as text on the X axis, along with the facility code). The figure shows that, with a few exceptions, few failures were registered on the ESDV closure test in 2013.

The industry standard for the ESDV closure test is 0.01, and the figure above shows that nine facilities exceed the industry standard for the percentage of failures in 2013 and 19 for the average value.

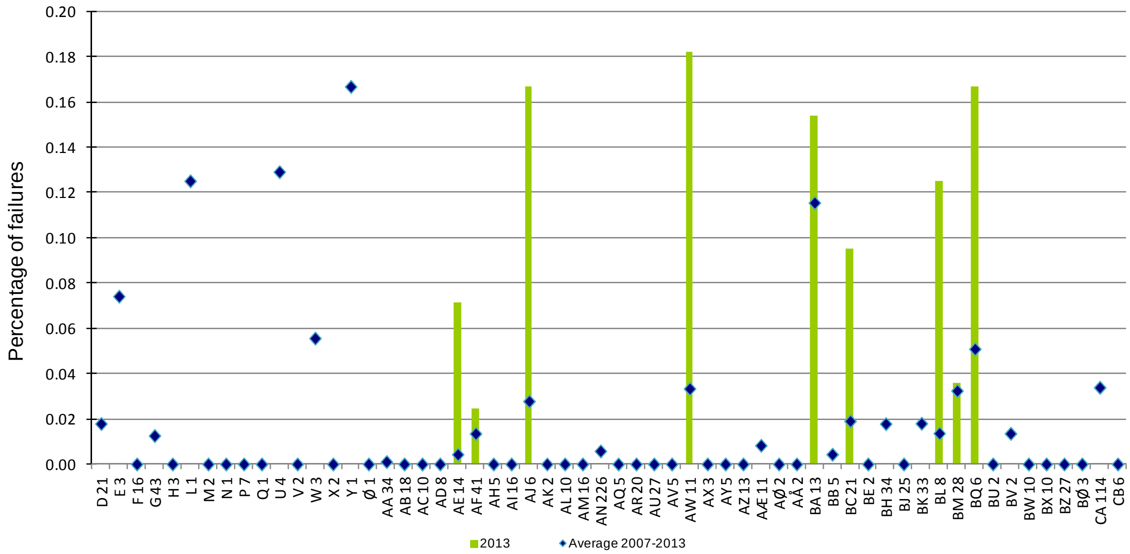


Figure 23 Percentage of failures for riser ESD valves (closure test)

As regards production facilities, barrier data has now been collected for 10 years for most barriers. Overall, many facilities performed below or far below the industry standard for several of the barrier elements, both in 2013 and on average for the entire period. Taking into account the industry's recent focus on major accident prevention, one would expect it to be possible to achieve greater improvements in this area than are shown by data from recent years.

Table 2 shows how many facilities have carried out tests for each barrier element, the total number of tests, the average number of tests for the facilities that have carried out tests, the overall percentage of failures and the mean percentage of failures for 2013 and for the period 2002-2013. This can then be compared with availability requirements for safety-critical systems. Figures in bold indicate that the percentage of failures exceeds the industry standard.

The table shows that, overall, most barrier elements are below or about on a par with the industry standard for availability. As in the previous year's RNNP report, the mean percentage of failures for 2013 and the mean percentage of failures for 2002-2013 for riser ESDVs and bleed-down values (BDVs)[4] are above the industry standard. The same applies to the average value for 2002-2013 for DHSVs which were also somewhat above the industry standard in 2013. A new factor in 2013 is that deluge valves have exceeded the industry standard both in terms of mean percentage of failures for 2013 and mean percentage of failures for 2002-2013.

[4] The industry standard of 0.005 for BDVs is relatively strict, but even with a less strict industry standard, for example at 0.02 as for DHSV and Christmas trees, a considerable number of facilities would still be far above the industry standard.

Table 2 General calculations and comparison with industry standards for barrier elements

Barrier elements	Number of facilities where tests were performed in 2013	Average, number of tests, for facilities where tests were performed in 2013	Number of facilities with a percentage of failures in 2013 (and avg 02-13) higher than industry standard	Mean percentage failures in 2013	Mean percentage failures 2002-2013	Industry standard for availability (Statoil)
Fire detection	68	856	7 (7)	0.003	0.004	0.01
Gas detection	69	434	12 (18)	0.006	0.009	0.01
Shutdown:						
· Riser ESDV	60	25	9, 7 (19, 15)*[5]	**0.018**	**0.020**	0.01
· Wing and master (Christmas tree)	65	264	8, 11 (3, 8)*[2]	0.011	0.01	0.02
· DHSV	66	133	16 (23)	0.02	**0.0202**	0.02
Bleed-down valve (BDV)	56	66	22 (43)	**0.017**	**0.023**	0.005
Pressure safety valve (PSV)	66	190	10 (12)	0.021	0.026	0.04
Isolation using BOP	27	104		0.004	0.021	*[6]
Active fire safety:						
· Deluge valve	68	32	11 (21)	**0.028**	**0.012**	0.01
· Start test	58	151	5 (10)	0.002	0.004	0.005

9.2 Barriers associated with marine systems

In 2013, data was collected for the following marine barriers on mobile facilities:

- Watertight doors
- Valves in the ballast system
- Deck height (air gap) for jack-up facilities
- GM values for floating facilities at year-end.

Data collection was carried out for both floating production and mobile facilities. There are considerable variations in the number of tests per facility, from daily tests to twice per year. Approx. 18,000 tests of watertight doors and approx. 99,000 tests of ballast valves were carried out in 2013.

The failure frequencies for these systems in 2013 were 0.0038 for tests on watertight doors and 0.0044 for tests on ballast valves. The failure frequency for testing of watertight doors and testing of valves in the ballast system is a good deal lower for mobile facilities compared with this failure rate for production facilities.

9.3 Indicators for maintenance management

Maintenance is a key prerequisite for the technical condition of the facilities in general and for barriers against accidents in particular. The effectiveness of maintenance must

[5] For riser ESDVs and wing and master valves, the *closure test* and *leak test* figures apply, respectively.

[6] There is no comparable requirement for this barrier, as an availability requirement is not considered to be appropriate. Statoil's internal guidelines recommend following up failures in this barrier using trend analysis.

therefore have a high priority among both participants and the authorities. Since 2010, the PSA has collected data from the participants in order to follow up developments of a selection of indicators to supplement information from, among other things, audits of the participants' maintenance management. The objective is to acquire important information on trends in the effectiveness of maintenance early enough to focus the necessary attention and resources wherever there may be signs of increased risk.

The collected data reflect the operators' own figures and systems for maintenance management. The main report shows all the indicators; only two are shown here. Figure 24 and Figure 25 show the trends in, respectively, total backlog of preventive maintenance and total volume of outstanding corrective maintenance per year, totalled for all production facilities on the NCS.

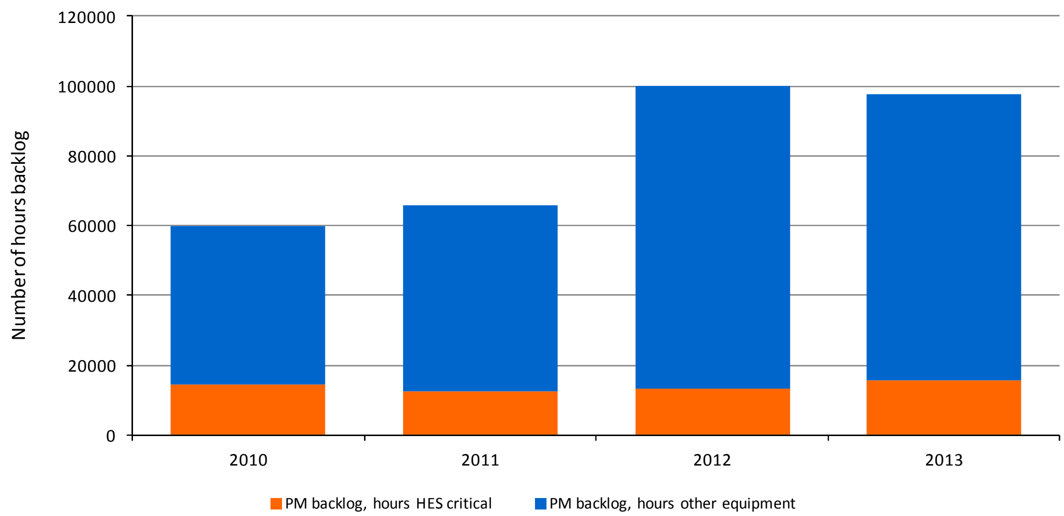


Figure 24 Trend 2010-2013 of total backlog of PM per year for production facilities on the NCS

The total for production facilities on the NCS in Figure 24 shows that the backlog of preventive maintenance for HSE-critical systems and HSE-critical equipment rose in 2013 from the previous year. Backlogs in this HSE-critical preventive maintenance may entail poorer technical condition and hence increased risk of accident.

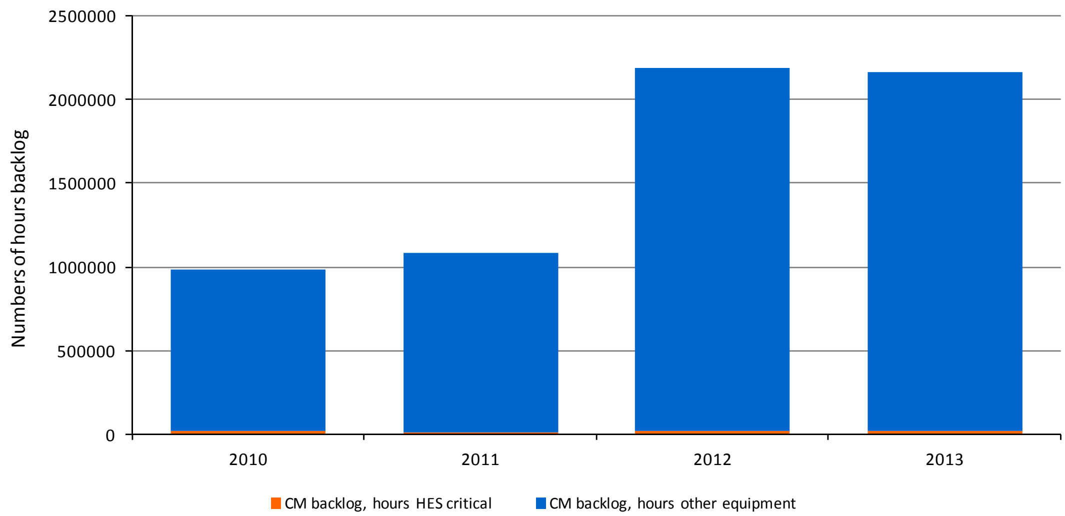


Figure 25 Trend 2010-2013 of total volume of outstanding CM per year for production facilities on the NCS

Figure 25 shows the total volume of outstanding corrective maintenance for production facilities on the NCS. We can see that the total volume of outstanding corrective maintenance in the last two years has been high, more than twice as high as in 2010 and 2011. The overall picture for 2013 has not changed significantly relative to the year before.

On several occasions, the PSA has emphasised that it is necessary for the operators to assess the volume of outstanding corrective maintenance as a contribution to the overall risk profile for each of the facilities.

The reported data for backlogs in preventive maintenance and outstanding corrective maintenance for mobile facilities shows great variation. This is similar to what we have seen in recent years. The PSA wishes to open a dialogue with the industry on this topic through the Norwegian Shipowners' Association.

10. Status and trends – work accidents involving fatalities and serious personal injuries

For 2013, the PSA registered 348 personal injuries on facilities in the petroleum activities on the NCS that fulfil the criteria of fatality, absence into the next shift or medical treatment. In 2012, 342 personal injuries were reported. There were no fatal accidents within the PSA's area of authority on the NCS in 2013.

In addition, 38 injuries classified as off-work injuries and 39 first aid injuries were reported in 2013. For comparison, in 2012 there were 43 off-work injuries and 57 first aid injuries. First aid injuries and off-work injuries are not included in figures or tables.

In recent years, we have seen a clear reduction in the number of injuries reported on NAV (Norwegian Labour and Welfare Administration) forms. In 2013, a total of 35.6% of the injuries were not reported to us on NAV forms, but were registered based on information received in connection with quality-assurance of data. The injuries not reported on NAV forms also include serious injuries.

On production facilities, in the period from 2003 to 2004, there was a clear fall from 15 to 11.3 injuries per million working hours. From 2004 to 2008, the overall injury rate was roughly unchanged at roughly 11 injuries per million working hours. In 2009, there was a significant fall from 11 to 8.6 injuries per million working hours. This positive trend also continued in the next three years and in this period, the total injury rate was under 8 per million working hours. In 2013, the injury rate is 7.2. This is a marginal fall from the 2012 level.

On mobile facilities, as for production facilities, there has been a positive trend on short-term. In the last three years, the total injury rate has levelled out and is now 7 personal injuries per million working hours. In 2010, we noted the lowest recorded rate (5.8) for the entire period. As on production facilities, mobile facilities have also seen a positive long-term trend, and the rate has more than halved relative to the 2003 level. It has declined regularly from 14.2 in 2003 to 6.7 in 2013.

10.1 Serious personal injuries, production facilities

Figure 26 shows the frequency of serious personal injuries on production facilities per million working hours. Over the long-term, there has been a very positive trend in the frequency of serious personal injuries on production facilities. In 2013, the frequency was less than one third of the 2003 level, which was the highest for the period. 2004 and 2008 stand out especially positively relative to the preceding year. Both of these years were followed by temporary setbacks: in 2005, there was an increase in frequency of 0.3 relative to the preceding year, and in 2009 the frequency rose by 0.2. Since 2009, there has been a regular downward trend right up to 2013 when we see the lowest injury rate on production facilities for the entire reporting period. In 2013, however, the injury rate for operators' employees rose relative to 2012, while the rate for contractors' employees fell. The 2013 injury rate for contractors' employees on production facilities was below the value expected based on the previous year, which is a highly positive development.

On production facilities, there were 12 serious personal injuries in 2013 against 14 in 2012. The number of working hours increased by 1.1 million hours, from 31.65 million in 2012 to 32.78 million in 2013.

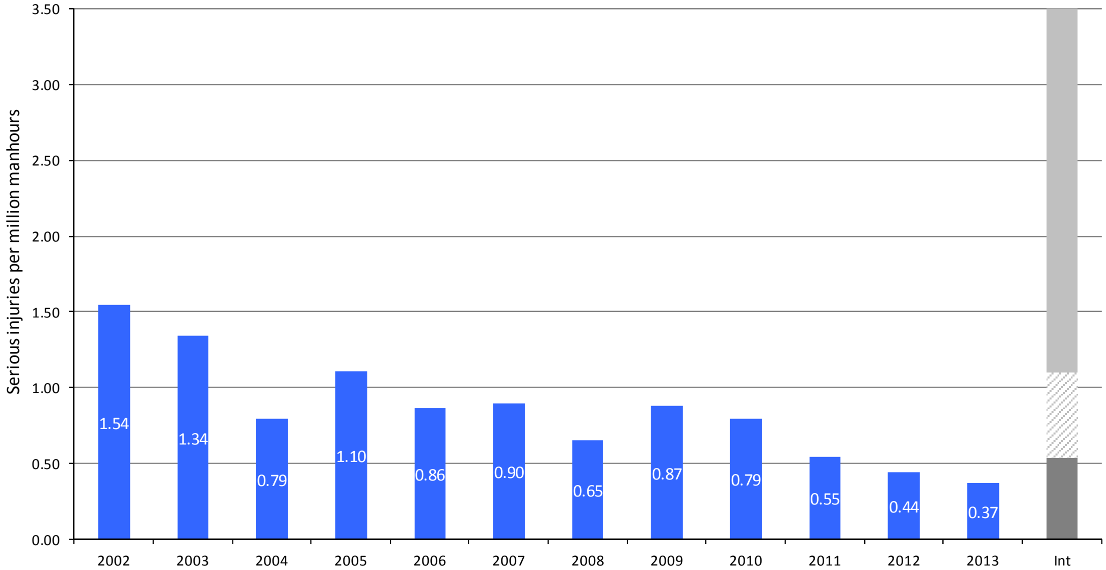


Figure 26 Serious personal injuries on production facilities relative to working hours

10.2 Serious personal injuries, mobile facilities

Figure 27 shows the frequency of serious personal injuries per million working hours on mobile facilities. We can see that there has been a marked fall in the last five years, compared with the period from 2003 to 2008, and in 2010 the rate was at its lowest ever. In 2011, the injury rate rose again, but the trend then flattens out in the next two years. In 2013, we have a marginal increase in the serious personal injury rate of 0.05 injuries per million working hours from 0.66 in 2012 to 0.71 in 2013. The injury rate is within the expected values based on the preceding 10 years.

The number of hours reported for mobile facilities in 2013 increased by 3.28 million, from 13.7 to 16.9 million, which is an increase of 24%. The number of serious personal injuries in 2013 was 12, compared with 9 in 2012.

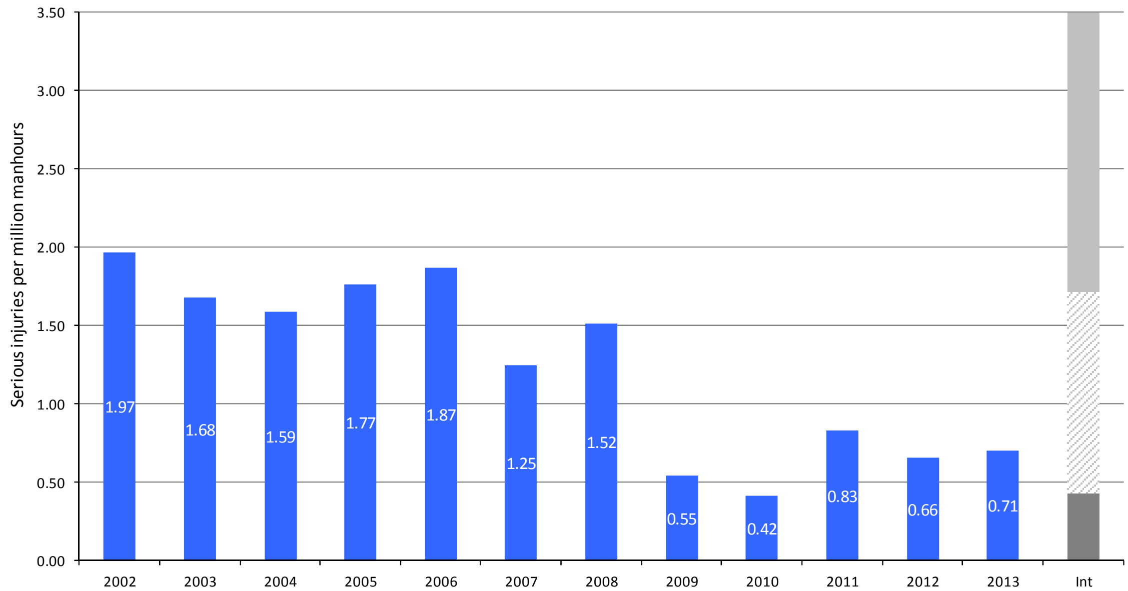


Figure 27 Serious personal injuries per million working hours, mobile facilities

10.3 Comparison of accident statistics between the UK and Norwegian shelves

Every six months, the PSA and the Health and Safety Executive (HSE) produce a joint report comparing offshore personal injury statistics. The classification criteria were initially virtually identical, but more detailed reviews revealed that the classification practice was somewhat different nevertheless. In order to improve the basis for comparison, in dialogue with the UK authorities, we have classified serious injuries according to joint criteria and such that they include equivalent areas of activity.

A calculation of the average injury frequency rate for fatalities and serious personal injuries for the period from 2008 up to the 1st half of 2013 shows that there have been 0.6 injuries per million working hours on the Norwegian Continental Shelf and 0.7 on the UK Continental Shelf.

The average frequency for fatalities on UK Continental Shelf is 0.6 per 100 million working hours, compared with 0.4 on the Norwegian Continental Shelf. This difference is not statistically significant. On the UK Continental Shelf, there were two fatalities during the period in question, compared with one on the Norwegian Continental Shelf.

11. Risk indicators – noise, chemical working environment and ergonomics

The emphasis of these indicators is on expressing risk factors as early as possible in the causal chain that may lead to an occupational injury or illness, and furthermore making them attractive for use in the companies' improvement work.

As regards noise and chemical working environment, with a few exceptions, data has been registered from all offshore and onshore facilities. As regards noise, the data set is characterised by a shared understanding of the reporting criteria and the indicator appears to provide a realistic and consistent picture of the actual conditions. It also appears to have good sensitivity to change. As regards the chemical working environment, changes and adaptations have been made in order for the indicators to best reflect the actual risk factors. The indicator was unchanged for 2013.

Indicators for ergonomic factors have been reported annually in the period 2009-2013. The reporting for 2009 was a pilot scheme, and changes made in 2010 meant that the figures for 2009 could not be compared with later years' results. In 2012, a few changes were made to the questions regarding risk management, which meant that some of the results here cannot be compared with the 2011 results. However, most of the results are comparable within the period 2010-2013. In 2013, changes were made to the layout and the form was designed in Excel. This change produced both simplification of the reporting itself and better statistical data.

The indicators are based on a standardised data set and will only capture parts of a complex risk profile. The indicators can therefore not replace the companies' duty to carry out exposure and risk assessments as a basis for implementing risk-reducing measures.

11.1 Noise exposure harmful to hearing

For 2013, data has been reported from 80 facilities, 43 fixed production facilities and 37 mobile ones. In addition, two floatels reported data. Among the fixed production facilities, 18 facilities are "new" and 25 are "older". By new facilities is meant those with an approved Plan for Development and Operation (PDO) dated since 1 August 1995. At this time, more stringent and detailed noise requirements were introduced (the SAM Regulations).

The noise exposure indicator covers eleven predefined position categories. In all, data has been reported for 2,837 individuals, representing approx. 7,500 employees offshore. This is an increase, since the number of individuals in 2012 was 2,669.

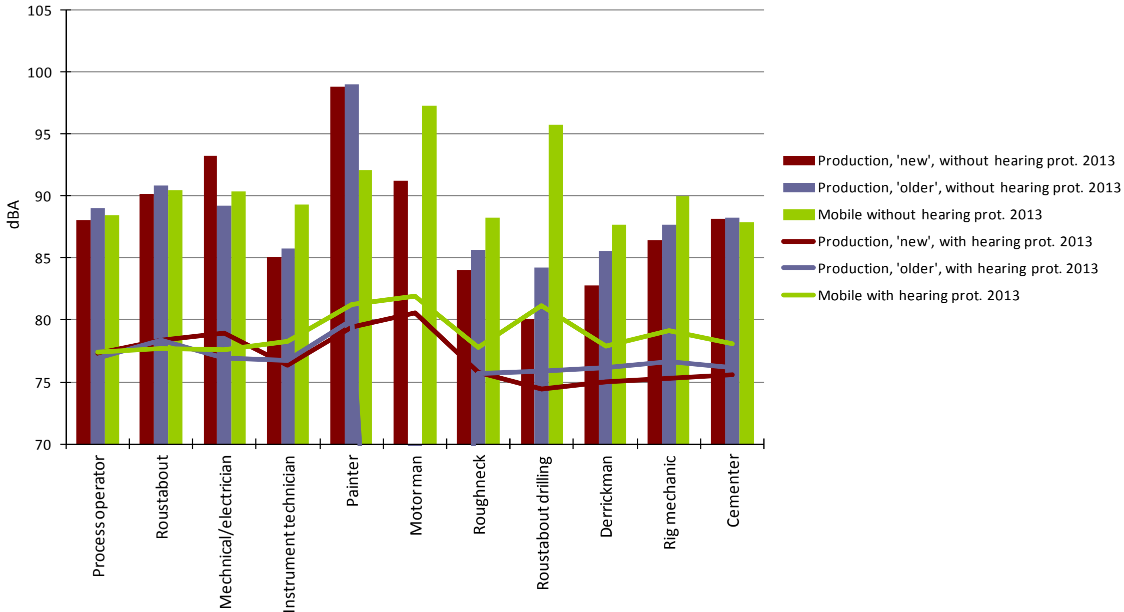


Figure 28 Average noise exposure for position categories and facility type, 2013

The results show an improvement for two out of eleven position categories from 2012 to 2013. This applies to the position categories of surface treatment personnel and rig mechanics. For eight position categories, there has been a negative trend over the last year, after several years of positive trends for certain of them. The average value for noise indicators for all activity on the NCS has changed from 90.2 in 2010, 89.3 in 2011, 89.1 in 2012 to 89.7 in 2013. This may be connected with an upward adjustment of the manning figures in individual position categories. At the facility level, there are also some annual variations that cannot be attributed to improvement, but rather the activity level and types. The average noise indicator for the facilities is significantly affected by, for example, how many surface treatment personnel have worked on board the facility in the reporting year. Viewed as a whole, the development in the noise indicator per position category provides the best assessment basis for changes.

The reporting confirms that several companies have formalised and implemented schemes for working hours restrictions. Of 80 facilities, six have not introduced such schemes for any position categories. This applies especially to mobile facilities. As in previous years, there is still a potential for improvement within this area for mobile facilities. Even though it may be difficult to verify that this type of measure is effective, there are examples to indicate that they do work. Such schemes may have operational disadvantages and may inherently be a driver for more robust technical measures.

In spite of the indicator pointing in the direction of high exposure, several of the facilities still do not have action plans for risk reduction, see Figure 29. The picture has developed in a negative direction, compared with 2012, for "new" and mobile facilities. For "older" production facilities, the picture is the same as in the year before.

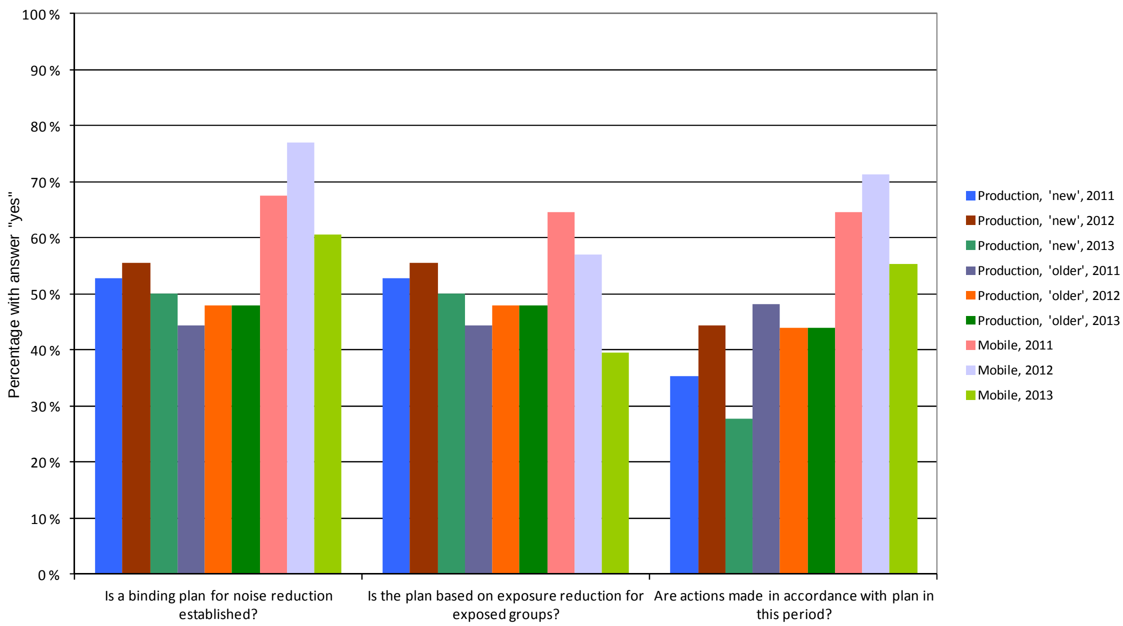


Figure 29 Plans for risk-reducing measures

In 2013, 403 new or worsened cases of hearing loss were reported, against 684 in 2012. For tinnitus, the figures are 82 cases in 2013 against 173 in 2012. There have been relatively large differences in reported harm from year to year. One reason for this is the companies' reporting routines. The level for 2013 is at roughly the reporting average for the last 7-8 years and it is therefore too early to say if the 2013 figures represent a falling trend.

The PSA has noted that, in recent years, both in the petroleum activities in general and in the companies themselves, there has been an increasing focus on and willingness to implement risk-reducing measures..

11.2 Chemical working environment

The indicator for the chemical working environment consists of two elements. One is the number of chemicals in use, distributed among health hazard categories (the chemical spectrum's risk profile), as well as actual exposure to defined position categories where we attempt to capture exposure with the highest risk. Supplementary information that provides an indication of the companies' risk management for chemical exposure has also been reported. The establishment of binding plans and follow-up of these are key in this context.

The indicator for the chemical spectrum's risk profile provides a picture of the number of chemicals in circulation per facility and how many of these have a high and defined risk potential. The indicator has limitations in that it does not take account of how the chemicals are actually used and the risk this represents. It does, however, say something about the companies' ability to limit the presence and use of potentially hazardous chemicals. It is a professionally recognised argument that the probability of exposure harmful to health increases with the number of hazardous chemicals in use.

For 2013, data has been reported from a total of 80 facilities, 41 fixed production facilities and 39 mobile ones. In addition, two floatels reported data.

The indicator for the chemical spectrum's risk profile shows that there is still considerable variation between facilities with regard to the number of chemicals in use (Figure 30 and Figure 31). To a certain degree, the variation reflects the type of facility and activities on the facility. Permanent installations generally have a higher number of chemicals in circulation than mobile facilities.

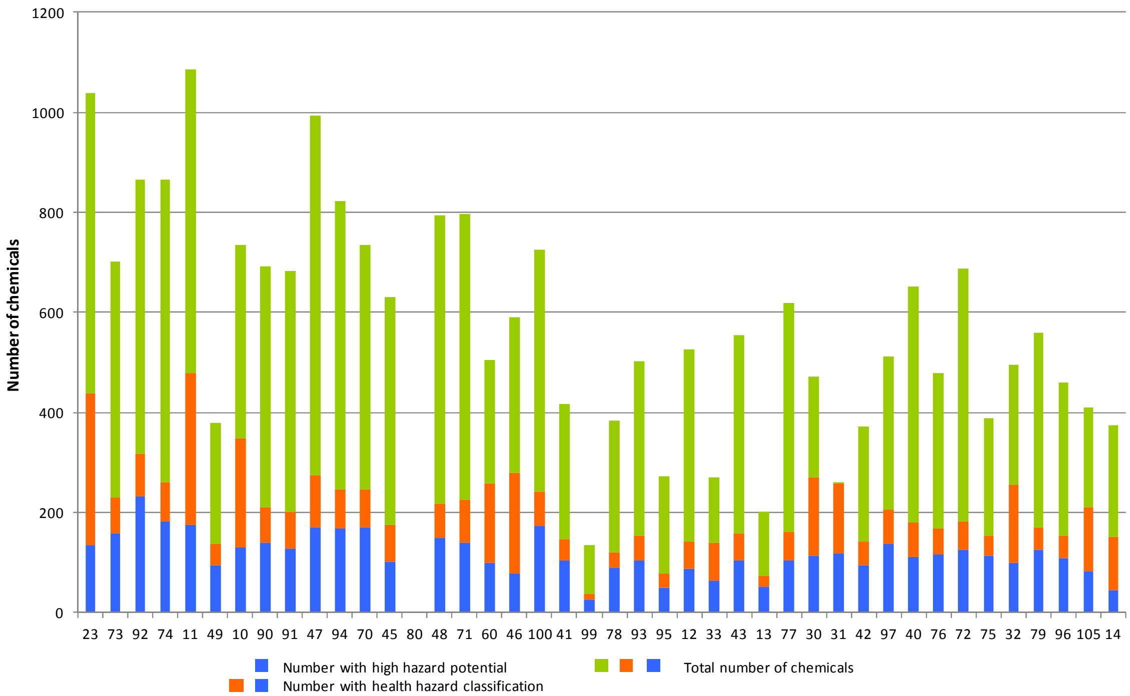


Figure 30 Indicator for the chemical spectrum's risk profile – fixed production facilities

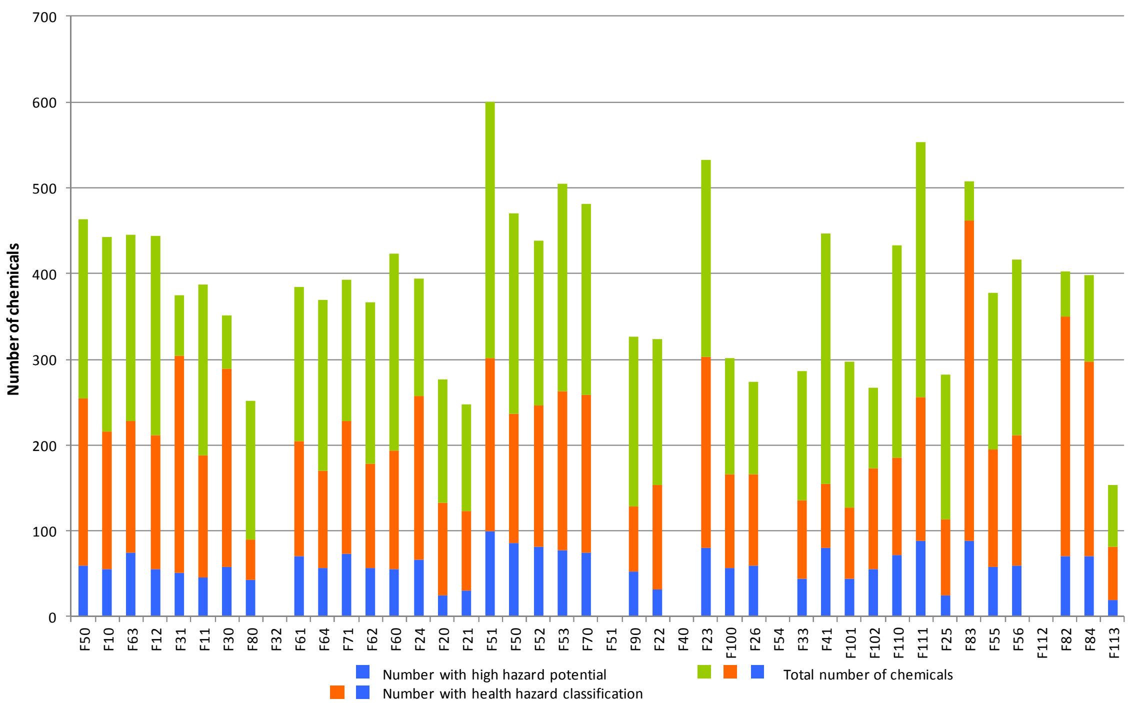


Figure 31 Indicator for the chemical spectrum's risk profile – mobile facilities

Figure 32 gives a picture of the companies' management of chemical exposure risk. For fixed facilities, 33% report having established a binding plan for the reduction of chemical exposure on the facility. This is an increase relative to 2012. 31% report having a plan based on the reduction of exposure for vulnerable groups, which is an improvement on the preceding year. 33% report having implemented measures in line with plans for the reporting period. This is an increase on the preceding year.

For mobile facilities, the picture is different in that just over 60% state having established a binding plan for the reduction of chemical exposure. This is worse than the preceding year, when the figure was 77%. Around 43% report having a plan based on the reduction of exposure for vulnerable groups, and just over 46% report having implemented measures in line with plans for the reporting period. This is a worsening from the previous year.

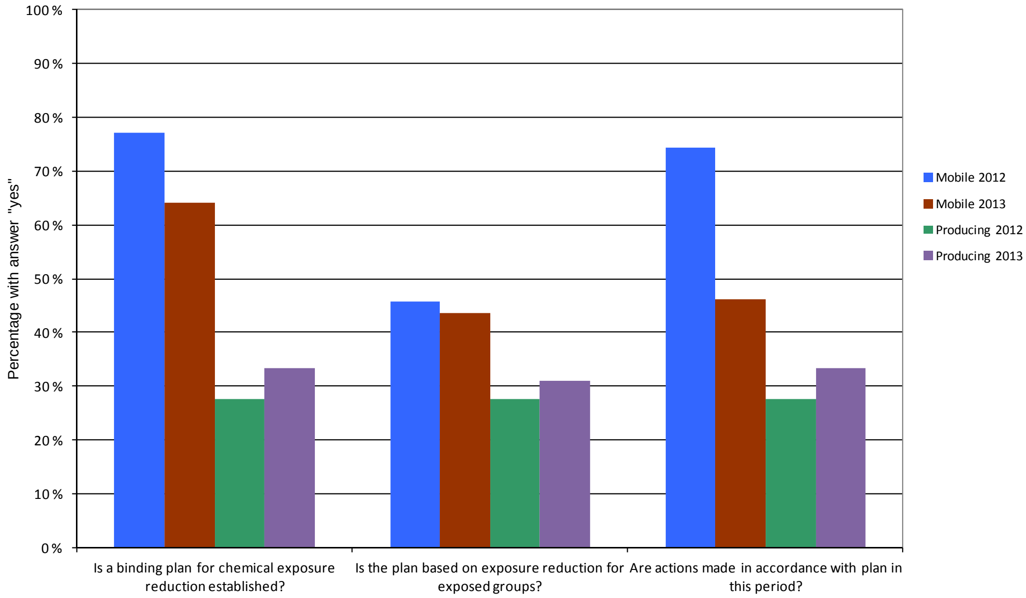


Figure 32 Management of risk of chemical exposure for mobile and production facilities

In 2013, 43 new cases of occupational skin diseases mainly caused by chemical exposure were reported.

11.3 Ergonomics

Indicators for ergonomic factors have been reported annually in the period 2009-2013. The reporting for 2009 was a pilot scheme, and changes made in 2010 meant that the figures for 2009 could not be compared with later years' results. In 2012, some changes were made to the questions about risk management. This means that some of the results here are not comparable with the 2011 results. However, most of the results are comparable for the years 2010-2013. In 2013, changes were made to the layout and the form was designed in Excel. The change contributed both to simplified reporting for the companies and quality assurance of the data basis and their processing. In connection with change in 2013, a working group was assembled consisting of participants from the industry with expertise in ergonomics. These provided input into the changes required to previous forms and feedback on the pilot version of the Excel reporting form.

The indicators have been developed in cooperation with specialist environments in the companies and STAMI. The status overview "Work as a cause of musculoskeletal disorders" was prepared by STAMI in 2008 on assignment from the Norwegian Labour Inspection Authority and the Petroleum Safety Authority Norway, and has been used as a basis in developing the indicators. The previous regulations relating to heavy and repetitive work with guidelines (amended on 1 January 2013) define the assessment criteria that shall form the basis for reporting. These criteria are restated in the Regulations relating to organisation, management and participation and the Regulations relating to the conduct of work, use of work equipment and associated technical requirements. The use of ergonomic specialist personnel has been emphasised by the Petroleum Safety Authority Norway.

Data have been reported from 54 production facilities and 40 mobile facilities. 1,179 work tasks were reported by the production facilities and 904 by the mobile facilities.

In the reporting form, working position, repetition, lifting/carrying and hand-held tools were classified as working environment factors. These factors were evaluated as red, yellow or green. In the *red* area, the probability of sustaining repetitive strain injuries is very high. A change in the working conditions from red to green will be necessary. In the *yellow* area, there is a certain risk of developing repetitive strain injuries over the short or long term, and the strains must be assessed more closely. Aspects such as the duration, tempo and frequency of the strain are particularly important. The combination of the strains may have an amplified impact. In the *green* area, there is a minor risk of repetitive strain injuries for most employees.

The quality of this year's reporting is better than previous years. This is to do with the new template available for reporting in 2013. In a few instances, however, the old form was used. In these cases, the sender was contacted and requested to use this year's template for reporting. By the end of reporting, all forms were available in the new Excel template.

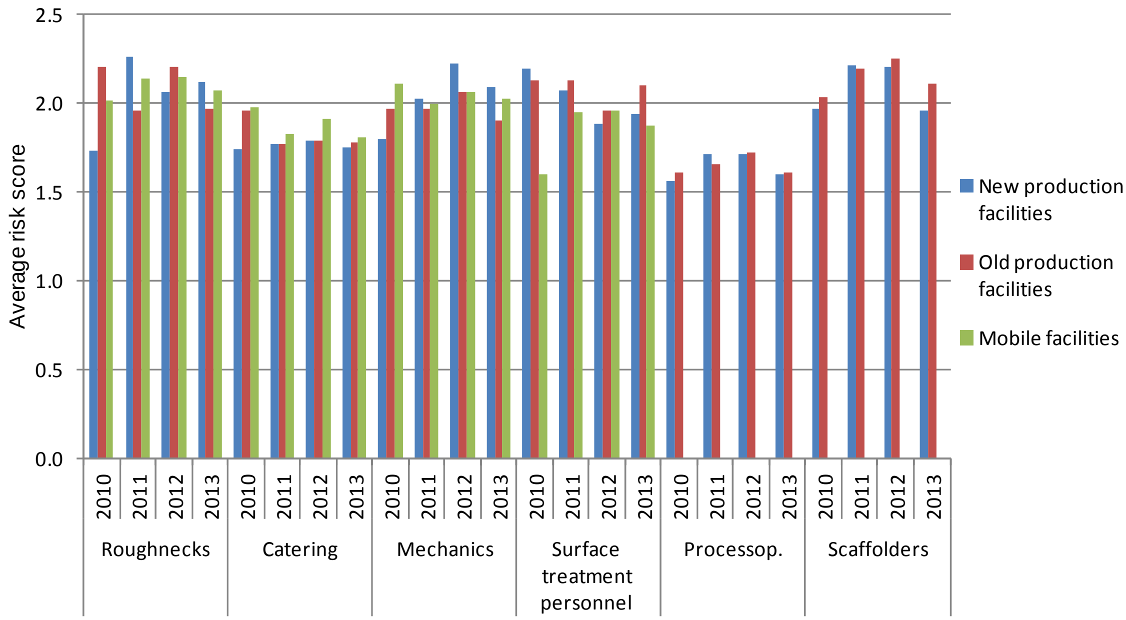


Figure 33 Average risk score for all work tasks broken down by employee groups on production and mobile facilities

The results show that on new production facilities and on mobile facilities, it is the roughnecks and mechanics who have the highest risk scores, whereas on older production facilities the highest risk scores belong to surface treatment personnel and scaffolders. For mobile facilities, a fall in risk scores is reported for all employee groups. For older production facilities, unchanged or lower risk scores are reported in 2013 relative to 2012 for everyone except for surface treatment personnel. On newer production facilities, equivalent or lower risk scores are reported for all employee groups except for roughnecks and surface treatment personnel, who had a slight increase in risk scores. Risk scores for mechanics on newer production facilities are somewhat lower than in 2012, but higher than in 2011 and 2010. All employee groups on production facilities report considerable improvements in a number of factors relating to the management of ergonomic risk compared with 2012. Roughnecks are the group reporting the best management. On mobile facilities, it is surface treatment personnel who report most gains in relation to risk management. The other employee groups on mobile facilities saw fewer changes compared with 2012. On both production facilities and mobile facilities, in excess of 97% report that expertise in ergonomics was used for completing the RNNP forms.

12. Other indicators

12.1 DFU21 Falling objects

During the period 2002-2013, an average of 220 incidents related to falling objects was reported to RNNP each year. In 2013, a total of 258 incidents were reported, which is the highest figure since 2008.

An analysis was conducted to categorise the incidents in accordance with initiating causes. The period 2006-2013 was assessed primarily. The categorisation was performed in accordance with the category model developed in the BORA project; see the main report. This method was originally developed to classify hydrocarbon leaks, but has been generalised and adapted for use on incidents with falling objects.

Figure 34 shows the distribution of incidents in main categories of work processes. The allocation of causes is different for the different work processes. For crane-related incidents, causal categories F and B dominate: External factors and Human activity which introduces a latent hazard. Incidents involving falling objects relating to crane-related work processes are also particularly interesting since the incidents are concentrated in the two highest energy classes.

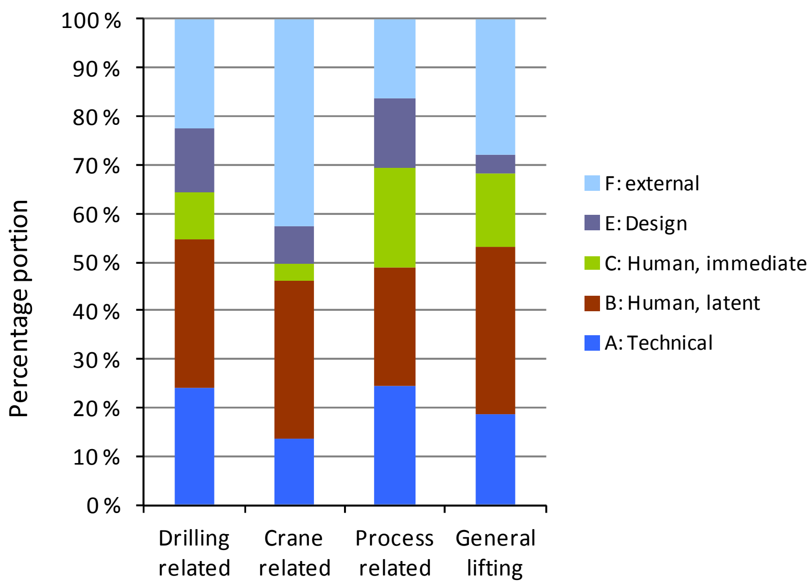


Figure 34 Triggering causes by main categories of work processes, 2002-2013

Figure 35 presents a detailed overview of causes of falling objects with the work processes of loading and offloading operations (from vessels) and lifting that takes place internally on a facility. The data for these work processes included registered incidents back to 2002. The F3 category – effects from collisions/hooking represents a relatively large proportion of the incidents in the main category of crane-related work processes. A large share of these incidents can be found within lifting activities that take place internally on the facility. A more comprehensive analysis can be found in the main report.

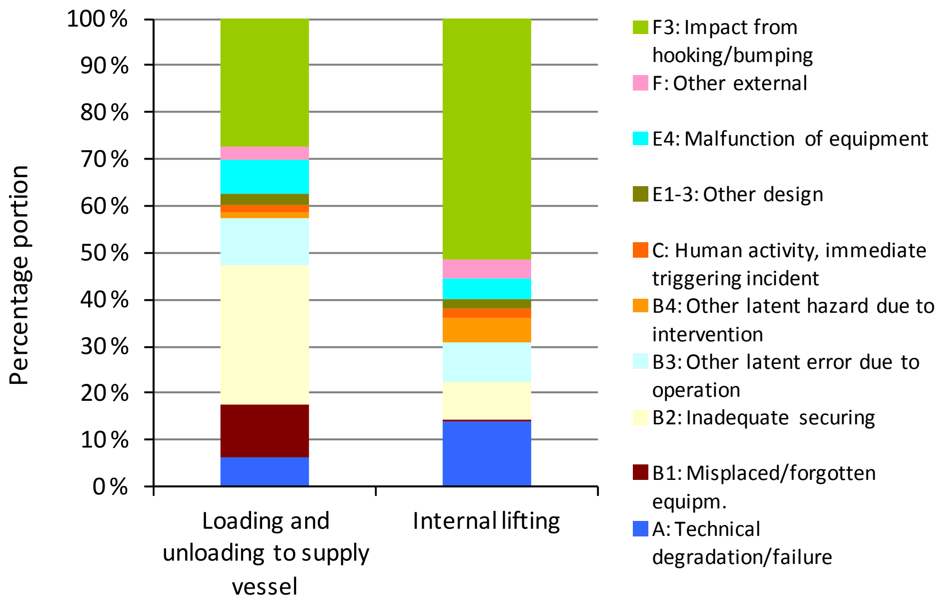


Figure 35 Triggering causes by detailed categories of work processes, 2002-2013

12.2 Other DFU

The main report presents data for incidents that have been reported to the Petroleum Safety Authority Norway, as well as for other DFUs without major accident potential, such as DFU10, 11, 13, 16 and 19, see Table 1.

13. Definitions and abbreviations

13.1 Definitions

See sub-chapters 1.9.1 - 1.9.3, as well as 4.2, in the main report.

13.2 Abbreviations

For a detailed list of abbreviations, see PSA, 2013a. Trends in the risk level on the Norwegian Continental Shelf, Main report, 25 April 2013. The most important abbreviations in this report are:

API	American Petroleum Institute
CODAM	Database for damage to structures and subsea facilities
DDRS/CDRS	Database for drilling and well operations
DFU	Defined hazard and accident situations
PM	Preventive maintenance
GM	Metacentric height
HSE	Health, safety and the environment
KPI	Key performance indicator
CM	Corrective maintenance
NPD	Norwegian Petroleum Directorate
PSA	Petroleum Safety Authority Norway
STAMI	National Institute of Occupational Health
WIF	Well Integrity Forum

14. References

Detailed reference lists can be found in the main reports:

PSA, 2014a. Trends in the risk level on the Norwegian Continental Shelf, Main report, 24 April 2014

PSA, 2014b. Developments in the risk level - onshore facilities in the Norwegian petroleum activities, 24 April 2014