The Document 3 series

Riksrevisjonen

The Office of the Auditor General's investigation of the PSA's follow-up of health, safety and environment in the petroleum industry

Document 3:6 (2018–2019)

This document is available at
www.riksrevisjonen.no

ISBN 978-82-8229-454-6

Illustration: Flisa Trykkeri AS. Shutterstock and Eni Norge.

The Office of the Auditor General's investigation of the PSA's follow-up of health, safety and environment in the petroleum industry

Document 3:6 (2018–2019)

To the Storting

The Office of the Auditor General hereby submits Document 3:6 (2018–2019) *The Office of the Auditor General's investigation of the PSA's follow-up of health, safety and environment in the petroleum industry.*

Documents in this series have the following subdivision:
- Summary of key findings, the Office of the Auditor General's remarks, recommendations, follow-up by the ministry and the Office of the Auditor General's closing remarks
- Appendix 1: The Office of the Auditor General's letter to the Minister
- Appendix 2: Reply from the Minister
- Appendix 3: Report on the administration audit department's investigation and assessments

The Office of the Auditor General uses the following terms for criticism, ranked according to highest severity:
1. **Very serious** is used to refer to circumstances where the consequences for society or the citizens concerned are very serious, e.g. risk to life or health.
2. **Serious** is used to refer to circumstances that could have major consequences for society or the citizens concerned, or where the sum of errors and deficiencies is so great collectively that the situation must be considered serious in itself.
3. **Very reprehensible** refers to circumstances that have less serious consequences, but which nevertheless concern matters of fundamental or major importance.
4. **Reprehensible** is used to characterise inadequate management where the consequences will not necessarily be serious. This could concern errors and deficiencies that have financial consequences, the infringement of regulations or matters that have been brought up previously but have still not been rectified.

The Office of the Auditor General, 15 January 2019

For the Board of Auditors General

Per-Kristian Foss
Auditor General

Contents

Ministry of Labour and Social Affairs

The Office of the Auditor General's investigation of the PSA's follow-up of health, safety and environment in the petroleum industry

The aim of the investigation was to assess whether the Petroleum Safety Authority's supervisory practices protect health, safety and environment (HSE) in connection with petroleum activities in accordance with parliamentary decisions. The investigation primarily covers the period from 2013–2017.

Petroleum activities entail a risk of accidents that could have significant consequences for people, the environment and material assets. These activities must therefore be carried out in a prudent manner and in accordance with the applicable regulations as stated in Section 10-1 of the *Act 29 November 1996 no. 72 relating to petroleum activities* (Petroleum Act). Authorities, industry players and the Standing Committee on Labour and Social Affairs have agreed that a central aim should be for Norwegian petroleum activities to be first class with regard to HSE, see Innst. 385 S (2017–2018) *Innstilling fra arbeids- og sosialkomiteen om helse, miljø og sikkerhet i petroleumsvirksomheten* (Norwegian only).

The Ministry of Labour and Social Affairs has overarching responsibility for managing the working environment, safety and preparedness in connection with petroleum activities. The Petroleum Safety Authority (PSA) is subordinate to the Ministry of Labour and Social Affairs and is responsible for supervising technical and operational safety, including the working environment and preparedness for unwanted incidents. The licensees that complete petroleum activities are responsible for ensuring that their activities are carried out in a prudent manner at all times. The primary task of the PSA is, through supervision and other available tools, to influence, follow up and make it possible for licensees to fulfil this responsibility.

There has been positive development in HSE in the Norwegian petroleum industry over many years. However, there were some negative developments in the years following the 2014 oil crisis. There have been several serious incidents and two deaths, and the number of personal injuries increased in 2017. Restructuring in the sector resulting from the oil crisis created challenges for the tripartite cooperation between employers, workers and authorities. On the part of the workers, it also raised questions as to whether the PSA has sufficient authority over the companies involved.

The investigation covers the PSA's supervision of the companies, use of sanctions, follow-up of events and reporting of concerns, granting of consent and acknowledgements of compliance (AoCs), and control of the PSA by the Ministry of Labour and Social Affairs. The investigation builds upon a broad overview of the PSA's supervisory practices, based on case studies of four installations/onshore production facilities, interviews, documents, supervision data, incident reporting and reports of concern. The case studies examine the PSA's follow-up of the Goliat production facility, the incident on the Songa Endurance drilling rig in autumn 2016, the incidents at the Mongstad onshore production facility in 2014 and 2016, and on the Nyhamna onshore

production facility. The four case studies were selected based on the associated risk and significance.

The investigation was based on the following decisions and intentions of the Storting:

- Report to the Storting 29 (2010–2011) *Joint responsibility for a good and decent working life* with Innst. 333 S (2011–2012)
- Report to the Storting no. 12 (2005–2006) *Helse, miljø og sikkerhet i petroleumsvirksomheten* (Norwegian only) with Innst. S. nr. 197 (2005–2006)
- Budsjettproposisjoner fra Arbeids- og sosialdepartementet med innstillinger for perioden 2016–2018 (Norwegian only)
- *Vedtak om opprettelse av Petroleumstilsynet* (Norwegian only), see Crown Prince's resolution of 19 December 2003.
- *Act 29 November 1996 no. 72 relating to petroleum activities* (Petroleum Act)
- *Act relating to working environment, working hours and employment protection, etc.* (Working Environment Act)

The report was submitted to the Ministry of Labour and Social Affairs in conjunction with a letter dated 20 September 2018. The Ministry commented on the report in a letter dated 17 October 2018. The comments have largely been incorporated into the report and this document.

The report, the letter of transmittal from the Board of Auditors General to the Ministry dated 14 November 2018 and the Minister's reply dated 28 November 2018 are included as appendices.

1 Key findings

- In the cases that have been investigated, the PSA's supervisory practices had a limited impact on the companies' follow-up of health, safety and environment issues.
  - Individual instances show that the PSA's methods of supervision do not contribute to the detection of serious safety concerns.
  - The companies do not always rectify regulatory nonconformities following notification, and the PSA does not always perform sufficient follow-up to ensure that nonconformities are rectified.
  - The PSA is slow to implement strict sanctions when these are needed, and does not do a sufficiently thorough job of investigating whether the companies have complied with orders
- In general, the PSA does a good job of following up incidents and reports of concern.
- The PSA granted consent for the commissioning of Goliat, despite the fact that the safety of the platform had not yet been properly guaranteed.
- The Ministry of Labour and Social Affairs does not obtain relevant information about the effectiveness of the PSA, nor does it investigate whether the PSA takes sufficient responsibility for cyber security.

2 The Office of the Auditor General's comments

2.1 The PSA's supervisory practices had a limited impact on the companies' follow-up of health, safety and environment.

The PSA must lay the groundwork and follow up to ensure that petroleum industry players maintain a high standard of health, safety, environment and preparedness; see *Crown Prince's resolution of 19/12/2003*. As with other sectors of industry, there are certain entities that are responsible for health, safety and environment. The PSA's follow-up investigations must be system-oriented and risk-based, and must be performed in addition to each company's own follow-up work. Implementing system-based supervision ensures that it is directed towards the relevant parts of the companies' management systems and any subsequent verifications. Implementing risk-based supervision ensures that it is directed towards issues and activities in which HSE is most challenging and critical, and towards situations that could present a risk of unwanted incidents or conditions, and where the PSA'sefforts are likely to have the greatest effect.[1] The supervisory activities are prioritised based on comprehensive assessments of where the risk is highest, and the method of supervision is adapted to the risk and the object of the audit.[2]

Overall, the authorities and industry players are of the opinion that the current HSE policy is robust and well-functioning, with a high level of safety. They also trust that the current system- and risk-based model for following up on HSE in petroleum activities is well suited to the task.[3] However, the investigation shows that there are significant challenges in certain areas. Despite close follow-up from the PSA, investigations, notices regarding breaches of regulations and the use of sanctions and other responses, in several instances the companies have failed to prioritise the rectification of regulatory nonconformities:

- The case study of Goliat demonstrates that the PSA's repeated documentation of nonconformities in the areas of logistics, working environment and ignition source control in the period 2012–2017 had a limited impact on the company's safety efforts. Eni failed to rectify significant regulatory nonconformities within a reasonable length of time.
- The case study of the Songa Endurance incident shows that the PSA repeatedly ordered Equinor to ensure that they took lessons from serious incidents. The underlying causes of the incidents were essentially the same. The Office of the Auditor General's judgement is that the PSA did not perform sufficient follow-up to ensure that Equinor did in fact learn from previous serious incidents. Equinor's own investigation of the incident in 2016 found that financial concerns took precedence over safety concerns, which played a key part in the incident occurring.
- The case study of the gas leak at Mongstad shows that, in the period 2010–2012, the PSA identified several nonconformities relating to maintenance regulations in the course of its supervisory activities and investigations. Equinor's investigation of the 2016 gas leak shows that the company did not follow up on all the nonconformities that the PSA identified. Cuts to appropriations for maintenance work, in combination with the failure to follow up on regulatory nonconformities, contributed to the serious incident in 2016. The PSA held too much trust that Equinor would rectify the regulatory breaches of its own accord.
- The case study of the cyber security incident at Mongstad in 2014 shows that the PSA's follow-up on Equinor's cyber security had little impact. The investigation shows that Equinor was facing cyber security challenges that the PSA failed to identify.

1) Report to the Storting 12 (2017–2018) *Health, safety and environment in the petroleum industry.*
2) Petroleum Safety Authority (2017) *Risikobasert tilsyn i hovedgruppene* (Norwegian only). Internal guidelines, last revised 2 May 2017.
3) Report to the Storting Report to the Storting 12 (2017–2018) Health, safety and environment in the petroleum industry.

The case studies contain several examples demonstrating that the PSA's supervisory practices have a limited impact on how the companies handle their responsibility for health, safety and environment. The case studies show that, in several instances, the companies did not follow up on orders or notices of regulatory nonconformities. Three of the four case studies involve the PSA's follow-up of Equinor, either directly as an operator or indirectly as a licensee. The investigation shows that the trust-based model for following up on petroleum activities creates challenges for the PSA when companies do not take the notices from the supervisory authority seriously. Equinor is responsible for over 70 per cent of all petroleum activity in Norway, and it is troubling that even this company does not follow up on notices from the PSA. By the judgement of the Office of the Auditor General, it is of serious concern that the PSA's supervisory methods, follow-up and use of sanctions have not had the desired effect.

2.1.1 Individual instances show that the PSA's methods of supervision do not contribute to the detection of serious safety concerns

One of the PSA's key tools for checking that companies are complying with the regulations is supervision in the form of audits and verifications.[4] The case studies show that the PSA carries out audits and verifications, and reveals breaches of the regulations. However, the case studies also show that serious incidents occur as a result of regulatory nonconformities that the PSA could have discovered if it had, to a greater extent, adapted its supervisory methods to the risks. At Mongstad there were many indications that Equinor was facing challenges concerning the maintenance of the facility.

The PSA had knowledge of the facility's recurring gas leaks, some of which were serious, and significant maintenance backlog. Nevertheless, in its supervision of maintenance at Mongstad in 2016, the PSA chose to carry out a system audit without verification of the actual conditions at the facility. Afterwards, the investigation of the incident found that several regulatory breaches contributed directly to the serious gas leak incident later that year. Admittedly, Equinor's own investigation of the incident shows that the company had more knowledge of the problems than the PSA was informed of in the supervision carried out in 2016. The Office of the Auditor General finds that it is nevertheless reprehensible that the PSA did not do more to control the actual situation at the facility.

Correspondingly, the case studies of Goliat and the cyber security incident at Mongstad show that the PSA had information about and indications of safety concerns, but chose to trust that the companies had these situations under control. This was the case with regard to ignition source control at Goliat and cyber security within Equinor. The PSA failed to carry out verifications that Eni and Equinor's plans, measures and procedures were put into practice. The Office of the Auditor General finds that, in these cases, the PSA put too much trust in the companies. The probability that the PSA would have discovered significant safety concerns would have been greater if they had chosen supervisory methods that took into account risk and significance in their follow-up. The Office of the Auditor General finds it reprehensible that the PSA failed to carry out verifications based on the knowledge of risks and challenges that was available to them.

4) Revisjoner er planlagte, systematiske gjennomganger av deler av styringssystemet i et selskap. Verifikasjoner er fysiske og stedlige undersøkelser i forbindelse med tilsyn for å undersøke om de faktiske forholdene er i samsvar med regelverket.

2.1.2 The companies do not always rectify regulatory nonconformities following notification, and the PSA does not always perform sufficient follow-up to ensure that nonconformities are rectified

When the Petroleum Safety Authority discovers regulatory breaches in the course of its supervision, it expects the companies to rectify these breaches within a given time period. The case studies of Goliat and Mongstad show that the companies submit reports in writing asserting that regulatory breaches have been rectified when this is in fact not the case. In the PSA's experience, measures to rectify identified nonconformities or improvement points can be assigned a lower priority relative to a company's internal budget processes. The case studies of Goliat and Mongstad show that, in some instances, the companies do not inform the PSA of the true HSE situation during supervision. The Office of the Auditor General believes that the PSA does not to a sufficient extent verify that oral and written feedback from the companies is in line with reality. Consequently, the companies may not rectify regulatory breaches, which in turn increases the risk of incidents.

In 2017 and 2018 the PSA escalated its follow-up of previously identified regulatory breaches. However, the case studies show that this type of follow-up was first implemented only after serious incidents occurred or as a result of reports of concern. For instance, the PSA followed up on and verified the planning and execution of Equinor's drilling activities after the Songa Endurance incident. The same was done following the gas leak at Mongstad in 2016. The supervisory authority also verified that Eni had complied with the order to cease production at Goliat, which was issued due to serious nonconformities in the electrical system, before Eni was permitted to resume production. The supervisory activities that prompted the order to cease production were based on a report of concern regarding the electrical system at Goliat from September 2017. The Office of the Auditor General takes a positive view of the fact that the PSA escalated its follow-up on prior regulatory breaches. Nevertheless, the Office of the Auditor General finds reprehensible the degree to which the PSA relies upon meetings and written statements from companies in its evaluations of how regulatory breaches have been followed up on. The investigation shows that, in several cases, the PSA fails to verify that oral and written feedback from the companies is in alignment with reality.

2.1.3 The PSA is slow to implement strict sanctions when these are needed, and does not do a sufficiently thorough job of investigating whether companies have complied with orders

The PSA has several legal responses at its disposal in the event that it uncovers breaches of the regulations. These legal responses include orders, coercive fines, suspension of operations and penalties for violation. The use of sanctions must be reflective of the materiality and significance of the regulatory breach in question. Additionally, the PSA is entitled to report cases to the police.

The PSA rarely uses sanctions more severe than the issuance of orders. The PSA finds orders to be a very effective tool, and typically the most effective means of influencing companies to rectify any nonconformities. This appears to be a reasonable premise when the PSA can trust that companies will take their responsibility seriously and comply with the regulations.

The investigation also shows that the PSA issues orders in cases containing findings that they judge to be serious. The PSA therefore seldom uses the other responses at its disposal, and has only used suspension of operations once in the period under investigation. The responses of coercive fines and penalties for violation have never been used.

The case study of Goliat shows that the PSA is overly hesitant to impose strict sanctions. The same serious nonconformities were revealed in repeated supervisory activities over several years, yet the PSA did not escalate its use of sanctions. Only in autumn 2017, after the platform had been in service for a year and a half, did the PSA order Eni to suspend operations. This was after the authority had once again discovered insufficient control of ignition sources. Control of ignition sources was also a requirement for the PSA's consent to begin using the facility, which was granted in January 2016. The company claimed that the serious regulatory breaches had been rectified, when in reality they had not. As a result of the PSA's hesitancy to escalate its use of sanctions, work on Goliat was begun without sufficient control of ignition sources. The Office of the Auditor General finds it very reprehensible that the PSA did not employ the sanctions at its disposal against the company when this was needed. Consequently, this could mean that nonconformities are not rectified in time and that the risk of serious incidents increases.

The case study of the Songa Endurance incident shows that orders issued after serious incidents in which Equinor was the operator did not have a sufficient impact. Five serious incidents that occurred in the period 2004–2016 have many of the same underlying causes. The PSA drew attention to these causes in prior supervisory work and investigations, and Equinor was ordered to address them. In the orders issued after the incidents on Gullfaks C in 2010, at Heimdal in 2012 and on Songa Endurance in 2016, the authority stated that Equinor must evaluate why previous measures implemented after earlier incidents had not been effective. The PSA did not perform sufficient follow-up on orders issued after previous serious incidents. Even after the last incident in 2016, there are indications that Equinor did not follow up on the orders. The Office of the Auditor General finds it very reprehensible that the PSA puts too much trust in the plans and measures that companies present to comply with orders, and does not do enough to confirm that these plans and measures are in agreement with the facts. This could result in Equinor not implementing necessary plans and measures, which thereby does not reduce the risk of new, serious well-control incidents or gas leaks where Equinor is the operator.

2.2 In general, the PSA does a good job of following up incidents and reports of concern

Serious incidents that have or could have resulted in death, serious injury, acute life-threatening illness, the impairment of safety-related barriers that could have put the facility at risk, and/or acute contamination must be reported to the PSA by the operator.[5] The PSA is obliged to follow up on the incidents and to supervise or investigate depending on the degree of severity.

The case studies of Goliat, the Songa Endurance incident, Nyhamna and Mongstad, as well as the general review of how incidents are treated show that, in most cases, the PSA follows up on incidents that are reported by the companies involved. The authority appears to have good systems for receiving and recording incident reports, and follow-up on the incidents is traceable through the authority's case processing systems. The operators are ordered to report incidents to the PSA within given deadlines. However, there are examples where companies have, for various reasons, failed to report incidents.

In recent years the PSA has noted several failures to report incidents in the course of its supervisory work, but the authority does not have the impression that under-reporting is a widespread problem.

5) Management Regulations, section 29.

The PSA must follow up on and process reports of troubling conditions in accordance with applicable law and with the authority's own procedures. The investigation shows that, in most cases, the PSA's follow-up on reports of concern is in line with the requirements set forth for follow-up. The review shows that documentation of case processing in the PSA's archive system is, to some extent, lacking. In many instances the PSA's follow-up is insufficiently documented, even when the cases have been processed correctly according to the authority's procedures. Because the follow-up on reports of concern is not uniformly and comprehensively recorded and documented, the official information regarding the processing of cases is not complete.

2.3 The PSA granted consent for the commissioning of Goliat despite the fact that the safety of the platform had not yet been properly guaranteed

The PSA must grant consent to commission a facility when it trusts that the operator can run the facility in accordance with applicable laws and regulations. Consent is granted following an application submitted by the operator, and is based on said application as well as the PSA's previous supervision, meetings and experience with the operator.

The investigation shows that the PSA demonstrated too much trust that Eni would ensure Goliat was ready before operations began at the facility. The authority was aware that Eni did not have a complete overview of what had been done and what work was still outstanding, due to misclassifications in the company's management system. The PSA therefore did not have reliable information regarding the remaining work to be done on Goliat at the time when it granted consent. Eni was granted consent to commission Goliat on the condition that Eni and Equinor could document that specific requirements had been fulfilled, and that the planned work of completing the platform was carried out. The PSA did not request documentation of this, aside from a meeting in which the companies presented what had been done and what of the planned work was still outstanding. Additionally, the PSA did not verify whether the requirements for consent had been fulfilled, nor whether the planned work had in fact been carried out.

The PSA involved Equinor as a licensee to review and verify that Eni had taken the necessary actions to be able to start operations at Goliat. After its review, Equinor prepared a report that contained several critical findings, including the fact that there was great uncertainty regarding what work was still required to ensure control of ignition sources. The report was made available after the consent had been granted, and showed that much work was still required before the requirements of the consent were fulfilled. The PSA did not request Equinor's report and did not verify that Eni handled the findings in a satisfactory manner. Although the PSA demanded that Eni document that all safety systems were tested and in working order, the authority chose to trust Eni and Equinor's assessment that Goliat was ready for operation, without requesting documentation or verifying that the safety systems were indeed in working order.

The results of Equinor's review, the supervision of electrical and ignition sources in 2017 and the order that the PSA gave Eni in January 2017 to go through all the plans for commissioning work all substantiate the finding that the consent to commission Goliat was granted with too much trust that Eni would be able to handle the complex work that remained to be done. In the opinion of the Office of the Auditor General, previous experiences with the company indicate that the PSA should have ensured that the work that remained before Goliat was ready for commissioning was indeed completed before it granted consent to commission the facility. The Office of the

Auditor General finds it very reprehensible that the PSA did not verify whether the challenges that had followed the Goliat project were rectified before it granted consent.

2.4 The Ministry of Labour and Social Affairs does not obtain relevant information about the effectiveness of the PSA, nor does it investigate whether the PSA takes sufficient responsibility for cyber security

The Ministry of Labour and Social Affairs will set overarching goals, management parameters and reporting requirements for the PSA, and will carry out duties of management, follow-up and control to determine whether the authority achieves the goals that have been set.

Through the letter of commitment, the Ministry of Labour and Social Affairs requires the PSA to report on the effects that the authority's efforts have on industry players. Letters of commitment provide guidelines for how this should be measured and evaluated. The management parameters that should measure effect are increased awareness, increased motivation and increased prevention on the part of the licensees. In recent years the measurement of effect has been based on the companies' qualitative feedback to the PSA at annual meetings. The Office of the Auditor General does not believe that qualitative feedback from the companies provides adequate information about the authority's effectiveness.

In recent years the Ministry of Labour and Social Affairs has appointed committees that have evaluated the authority's follow-up on petroleum activities. The Ministry of Labour and Social Affairs has the right to appoint an independent investigative committee; see Section 10-10 of the Petroleum Act. The terms for appointing such a committee require that a serious accident or incident has occurred that has resulted in a serious risk of loss of life, substantial material damages or the pollution of the marine environment. The Ministry has not exercised the right to appoint an independent investigative committee since the West Vanguard blowout in 1985. There have been no major accidents in petroleum activities within the PSA's area of responsibility since 1985. There have, however, been numerous fatal accidents and many serious incidents that had the potential to become major accidents. If an independent investigative committee had been appointed, it could have provided useful information about how the PSA follows up on companies prior to serious incidents.

The Office of the Auditor General finds it reprehensible that the Ministry of Labour and Social Affairs did not secure accurate and relevant information about the effect of the PSA's supervisory activities on the HSE work of the companies involved. Without accurate information about the effect of the PSA's work, it is difficult for the Ministry to evaluate whether the authority is making the most effective use of resources.

The Ministry of Labour and Social Affairs was given responsibility for Section 9-3 of the Petroleum Act Emergency preparedness against deliberate attacks in 2013 and delegated this responsibility to the PSA the same year. However, the Ministry did not formulate this as a goal in a letter of commitment to the PSA in 2015. In 2017 it was specified that the goal should also apply to the ability of ICT systems to withstand operational errors, after it came to light in 2016 that Equinor had been affected by several incidents because the ICT systems did not have adequate protection.

The Office of the Auditor General finds it reprehensible that the Ministry of Labour and Social Affairs took such a long time to define the goals of the PSA's responsibility for cyber security.

The PSA has not specified which requirements for cyber security are implicated by Section 9-3 of the Petroleum Act because the authority believes that the requirements for licensees regarding emergency preparedness against deliberate attacks are covered by existing regulations. According to the PSA, further refinement of Section 9-3 of the Petroleum Act has been postponed pending new security legislation. ICT is used in all stages of petroleum activity, and if companies fail to protect cyber security, this can result in risks to health, safety and environment. The Office of the Auditor General finds it reprehensible that the Ministry has not performed adequate follow-up of how the PSA handles its responsibility for cyber security as stated in Section 9-3 of the Petroleum Act.

3 The Office of the Auditor General's recommendations

The Office of the Auditor General recommends that the Ministry of Labour and Social Affairs:

- ensures that the PSA performs more risk-based verification that regulatory nonconformities are rectified and that orders are complied with
- ensures that the PSA makes use of the available sanctions against companies for which this is necessary, and escalates the use of more severe sanctions as needed
- develops a more relevant means of measuring the results and effects of the authority's activities that covers the need for management information
- ensures that the PSA improves its follow-up on cyber security in petroleum activities

4 The Ministry's follow-up

The Minister of Labour and Social Affairs emphasises the importance of a high level of safety in petroleum activities, and refers to the government's goal that the petroleum industry be world-class in terms of health, safety and environment. The Storting and the petroleum industry also stand behind this. Because petroleum activity has a high risk potential, the industry is strictly regulated through the licensing system, and the participants are followed up through a comprehensive supervision regime. The entities are particularly resource-rich and run high-tech businesses; according to the Minister, this dictates that the supervisory authorities' follow-up is primarily done at an overarching system level. The PSA has moved away from detailed audits and towards an approach that places the accountability on the entities and in which the supervision is based on the entities' systematic follow-up of their own activities.

The current HSE regime has broad support and, according to the Minister, has played a significant part in the positive development and high level of safety in Norwegian petroleum activities. The Minister also refers to the fact that Report to the Storting 12 (2017–2018) *Health, safety and environment in the petroleum industry* was widely endorsed in the Storting in connection with its consideration.

The Minister refers to the Office of the Auditor General's main remarks relating to the PSA's supervisory practices and use of sanctions. The Office of the Auditor General has taken as its starting point four selected case studies and parts of the PSA's tools. The Minister refers to the fact that these projects are particularly demanding and are therefore not representative of the Norwegian petroleum industry or of the PSA's supervisory practices as a whole.

The PSA's strategy is based on dialogue and trust, and the authority seldom makes use of sanctions. According to the Minister, the benefit of this is that the responsibility is clearly placed on the companies and it leaves space for sending stronger signals when the authority does not trust in the entities' own follow-up. The Minister believes that the development may indicate that in some instances the PSA needs to be clearer in its use of sanctions and, based on risk analysis, check that nonconformities and orders are followed up on.

The Minister also refers to the fact that, following Report to the Storting 12 (2017–2018), the PSA is requested to clarify and further develop its supervisory strategy and use of sanctions. The Minister emphasises that it is crucial that the PSA is strong and clear, adapts to developments in the industry and has the competence and capacity to ensure legitimacy and authority in exercising its role as an authority. The Minister has also requested further development of Trends in risk level in the petroleum activity (RNNP), which can help to develop further knowledge of the challenges and risks facing the industry.

The Minister is satisfied with the Office of the Auditor General's finding that the PSA generally does a good job of following up incidents and reports of concern, and has noted that there is potential for improving the documentation of how reports of concern are processed in the authority's archive system.

As for the evaluation of the fact that consent to commission Goliat was granted without the platform's safety being properly guaranteed, the Minister notes that this was a demanding project. As a result, based on dialogue with the PSA, the Ministry assigned the authority to carry out an investigative project. The project will evaluate challenges and measures for improvement following the construction of Goliat and several other construction projects. According to the Minister, the investigation will encompass all stages and will be used for education and improvement, both in the industry and for the authorities.

The Minister agrees with the Office of the Auditor General that the measurements and reports of effectiveness that the PSA has used so far have not provided adequate qualitative information about the effects of the authority's work. The Minister notes that management was previously oriented towards the execution of activities and that there has been increased awareness of the effects of the authority's work. The Minister notes that measuring the effects of supervision is complex and therefore efforts are being made to secure better management information about the effects of the PSA's work. For example, user surveys were carried out in 2018 that will be able to provide better information about how the PSA's work affects the industry. This, together with RNNP and experiences from the authority's work will be able to provide a strong foundation for analysing and evaluating effects. According to the Minister, further work to assess whether the PSA's efforts have long-term effects and contribute to the achievement of the goals set out by the Storting in Prop. 1. S will require evaluation and R&D. The Minister has initiated a research project (2018–2020) that will examine how the use of sanctions affects the working environment. This concerns firstly the Labour Inspection Authority, but will also be able to provide useful information about the effects of sanctions.

In addition, the Minister notes that investigations of incidents and accidents are an important source of information about the course of events and underlying causes, and can provide useful information about the authorities' follow-up. The Ministry is therefore working to assess existing investigation schemes where independent investigations can be initiated as needed.

As for cyber security, the Minister notes that this is an important area and that ICT solutions have been used in the petroleum industry for a long time. There has therefore been awareness of this for some time, for example in connection with discussions of integrated operations and remote control. The Minister agrees with the Office of the Auditor General that this is an important area, which will become no less relevant in years to come. Appropriations for the PSA have therefore been increased in this area and are followed up on in the management dialogue.

The Minister also remarks that the Office of the Auditor General's recommendations regarding supervisory practice and use of sanctions are being worked on, including as part of the follow-up of Report to the Storting 12 (2017–2018). Going forward, the Minister will pay attention to the further development of management information that will provide a foundation for analysis and evaluation of the effects of, and use of resources in, supervisory activities.

The Ministry will also follow up on cyber security.

5 The Office of the Auditor General's closing remarks

The Office of the Auditor General finds it serious that the PSA's supervisory practices in the cases that have been investigated have had a limited impact on the companies' follow-up of health, safety and environment issues. The Minister believes that the four case studies concern particularly demanding projects, and that these are not representative of the PSA's supervisory practices overall.

The Office of the Auditor General wishes to emphasise that the selection of case studies was made based on the fact that these are facilities that, for various reasons, had a particular need for follow-up from the PSA. The PSA also followed up on these facilities more closely than is typical. The Office of the Auditor General would also like to add that Equinor plays a central role in three of the case studies. The Office of the Auditor General also notes that the Minister will follow up on the recommendations and ensure that the PSA clarifies and expands its supervision strategy and use of sanctions, and has requested that the PSA be clearer in its use of sanctions in individual instances and verify that nonconformities and orders are followed up on.

The case will be submitted to the Storting.

Adopted at the meeting of the Office of the Auditor General on 11 December 2018

Per-Kristian Foss **Helga Pedersen**

Anne Tingelstad Wøien **Arve Lønnum**

Jens Arild Gunvaldsen

Appendix 1

The Office of the Auditor General's letter to the Minister

Riksrevisjonen

Our case officer
Tom Næss 22241228

Our date	Our reference
14/11/2018	2017/01326-77
Your date	Your reference

MINISTRY OF LABOUR AND SOCIAL AFFAIRS
Postboks 8019 Dep
0030 OSLO

Forwarding of Document 3:x on the Office of the Auditor General's investigation of the PSA's follow-up of health, safety and environment issues in the petroleum industry

Please find enclosed a draft version of Document 3:x (2018–2019) *The Office of the Auditor General's investigation of the PSA's follow-up of health, safety and environment issues in the petroleum industry.*

The document is based on a report that was sent to the Ministry of Labour and Social Affairs in connection with our letter dated 20 September 2018, and on the Ministry's reply dated 17 October 2018.

The Minister is asked to explain how the Ministry will follow up the Office of the Auditor General's remarks and recommendations, and whether the Ministry disagrees with the Office of the Auditor General.

The Ministry's follow-up will be summarised in the final document submitted to the Storting. The Minister's reply will be enclosed with the document in its entirety.

Deadline for reply: 28 November 2018.

For the Board of Auditors General

Per-Kristian Foss,
Auditor General

The original letter in Norwegian has been translated into English

Appendix 2

The Minister’s reply

DET KONGELIGE
ARBEIDS- OG SOSIALDEPARTEMENT

The Minister

Office of the Auditor
General Postboks
8130 Dep
0032 OSLO

Confidential; see
Freedom of Information
Act Section 5, second
paragraph

Your ref.	Our ref.	Date
	17/1663-24	28 November 2018

The Minister's response to the draft of Document 3:X (2018–2019) regarding the Office of the Auditor General's investigation of the PSA's follow-up of health, safety and environment issues

I refer to the Office of the Auditor General's letter dated 14 November 2018 regarding the investigation of the PSA's follow-up of health, safety and environment issues in the petroleum industry. The Office of the Auditor General requests a statement detailing how the Ministry of Labour and Social Affairs will follow up on the OAG's remarks and recommendations.

First and foremost, I must emphasise the importance of a high level of safety in the petroleum industry. This is an industry that operates within both natural and technological conditions, which means that errors and accidents have the potential to inflict serious harm upon people, the environment and material assets. The government's goal is therefore that the Norwegian petroleum industry be a world leader in HSE, and both the Storting and a united industry stand behind this goal.

Due to the risk potential, access to participation in the petroleum industry in Norway is strictly regulated through a licensing system in which all central activities in all phases require licences, consent or approval from the authorities. Furthermore, petroleum regulations set special requirements for control and safety, and entities are followed up on through a comprehensive supervision regime.

The petroleum industry is a particularly resourceful and high-tech industry characterised by rapid development. New concepts and modes of operation are adopted over time, and the parties involved are constantly changing. The industry encompasses many varied activities, both on land and at sea, and the players make up a diverse group of companies with different roles, responsibilities and competences. This complex reality means that the supervisory authorities' follow-up of the industry is carried out primarily at an overarching, systemic level.

The original letter in Norwegian has been translated into English

However, at the beginning of the 1980s, the authorities' supervisory follow-up of the Norwegian petroleum industry was characterised by detailed audits. Based on developments in the industry and experiences gained from incidents, the authority moved away from this approach and turned instead towards placing the responsibility on industry players and the systematic follow-up of their own activities.

The PSA's supervisory follow-up encompasses a broad spectrum of activities. The concept of supervision can be widely understood as all activities and use of sanctions performed for the purpose of following up on the industry. This includes traditional control activities such as audits and verifications, meetings with industry players and investigation of incidents throughout all phases of the petroleum industry. The most visible part of the supervision takes place on installations and onshore production facilities, but the supervision also includes the processing of applications and consent, data collection regarding accidents and incidents, investigations and processing of individual cases and follow-up and eventual use of sanctions. Additionally, the PSA carries out numerous activities on an annual basis that are aimed at addressing shared challenges in the industry.

A key basis for the PSA's risk-based follow-up of the industry is the project Trends in risk level in the petroleum activity (RNNP). The project monitors the development of risks in the petroleum industry and is organised in collaboration with the companies, authorities, industry associations, trade unions and relevant research institutions. Industry development is monitored using a number of indicators of safety and the working environment, and a report is prepared annually to show trends in the risk level over time. However, the measurements in RNNP do not cover every aspect of safety and the working environment, thus they provide only a simplified picture of a complex reality. The results are therefore supplemented with supervision experiences, industry influence, research results and reports of concern, among other things.

The current HSE regime of the petroleum industry has broad support and is believed to have played a significant part in the positive development and high level of safety in Norwegian petroleum activities. In April of this year I submitted a new report to the Storting, Report to the Storting 12 (2017–2018) *Health, safety and environment in the petroleum industry.* The current HSE regime and the signals given in the report received widespread endorsement in the Storting in connection with the consideration of this report.

In the following, I will respond to the individual main points of the Auditor General's comments.

1. **In the cases that have been investigated, the PSA's supervisory practices had a limited impact on the companies' follow-up of health, safety and environment issues**

The Office of the Auditor General's primary remark is that the PSA's supervisory practices have had a limited impact on the companies' follow-up of health, safety and environment issues. The Office of the Auditor General notes that in several instances, companies did not follow up on the PSA's orders or notices of regulatory nonconformities, and therefore recommends that the Ministry of Labour and

Social Affairs ensures that the PSA performs more risk-based verification that regulatory nonconformities are rectified and that orders are complied with. Furthermore, the Office of the Auditor General points out that the PSA is slow to implement strict sanctions when these are needed, and therefore recommends that the Ministry ensures that the PSA makes use of the available sanctions against companies for which this is necessary, and escalates the use of more severe sanctions as needed.

In the investigation of the PSA's follow-up of health, safety and environment issues in the petroleum industry, the Office of the Auditor General took as its starting point four selected case studies and parts of the PSA's responses. As mentioned in our comments on the draft auditee criteria from 20 October 2017, the four case studies focus on projects that must be acknowledged as having been particularly demanding. These are therefore not representative of the Norwegian petroleum industry and the PSA's supervisory practices overall.

The PSA's supervision strategy is based on dialogue and trust, and the authority seldom makes use of formal sanctions. The goal of the responses, including sanctions, is to place responsibility on the companies in question and encourage them to work systematically when addressing health, safety and environment. One benefit of this cautious use of formal sanctions is that the responsibility for follow-up is placed clearly on the companies themselves, and it leaves space for the authority to send stronger signals when it does not trust in the companies' own follow-up.

A dialogue-based approach to follow-up promotes learning and highlights the industry's responsibility, but the industry tends to perceive this more as guidance and counselling than as supervision by an authority. The choice of responses must be based on what has the greatest effect, and I believe that the authority itself must evaluate the use of tools in individual cases based on professional expertise. Developments may indicate that in some instances the PSA needs to be clearer in its use of sanctions and, based on risk analysis, ensure that nonconformities and orders are followed up on.

In November 2016, as a crucial foundation for the new white paper on health, safety and environment in the petroleum industry, I invited relevant parties and authorities to a working group for a joint assessment and discussion of the HSE situation and development in the Norwegian petroleum industry. Both the working group's report and the white paper contain key points for further follow-up that the industry is responsible for, as well as matters relating to the PSA's supervisory follow-up.

As an important point of follow-up to the HSE white paper, I asked the PSA to clarify and expand upon its supervision strategy and use of sanctions. I believe that it is essential that the PSA be a strong and clear authority that continually adapts to industry developments. This means that the authority must actively and systematically employ the full range of available tools if necessary. To ensure that the PSA has legitimacy and authority in performing its role, the supervisory agency must ensure its competence and capacity to evaluate future developments, what implications these may have for supervision, responses and potentially the need for revised regulations. I have also requested that work begin to expand RNNP, including measures to increase

the response rate and ensure the quality of the questionnaire-based survey, which will contribute to further knowledge of the challenges and risks facing the industry.

I believe that it is important to emphasise that the regime for HSE follow-up in the petroleum industry has been developed over time and has proved itself to be well-functioning. This regime will continue, but in order to follow up and ensure that supervision of the industry is risk-based and adapted to industry developments and particularly demanding situations, I have asked the PSA to clarify and expand its supervision strategy and use of sanctions. In its consideration of the HSE white paper, the Storting has also agreed that the PSA must clarify its strategy and employ the full range of sanctions. Work to achieve this target has begun and will be followed up on by the Ministry through the agency management dialogue and other means.

2. **In general, the PSA does a good job of following up incidents and reports of concern**

I am satisfied with the Office of the Auditor General's finding that the PSA generally does a good job of following up incidents and reports of concern, and it has been noted that there is potential for improving the documentation of how reports of concern are processed in the authority's archive system.

3. **The PSA granted consent for the commissioning of Goliat despite the fact that the safety of the platform had not yet been properly guaranteed**

As stated in point 1, the four selected case studies upon which the Office of the Auditor General has based its audit concern projects that were particularly demanding. Based on dialogue with the Ministry, the PSA initiated an investigation to assess the challenges and means of improvement after the construction of Goliat, as well as several other construction projects. The investigation will encompass all stages of the industry and will be used for education and improvement, both in the industry and for the authorities. In addition, I refer to my response to point 1, above.

4. **The Ministry of Labour and Social Affairs does not obtain relevant information about the effectiveness of the PSA, nor does it investigate whether the PSA takes sufficient responsibility for cyber security**

The Office of the Auditor General remarks that the Ministry does not obtain relevant information about the effects of the PSA's work. I agree with the Office of the Auditor General that the measurements and reports of effectiveness that the PSA has completed so far have not provided adequate qualitative information about the effects of the authority's work.

In recent years, the Ministry has oriented its agency management towards increased awareness of the effects of the PSA's follow-up work. This has been a reorganisation process as compared with the previous management focus, which was to a greater extent oriented towards the completion of activities. Measuring the effects of supervision is a complicated task that must account for several different dimensions, and we are working on specific development efforts to gain better management information about the effects of the PSA's work, among other things.

In 2018 the PSA signed a contract with an external supplier for user surveys relating to the agency's supervision work. This will contribute to better quality and more impartiality in feedback regarding the extent to which the PSA's work leads to better preventative efforts in petroleum activities. Together with the agency's own supervision experiences and information from RNNP, information gained from user surveys will provide a strong foundation for analysis and evaluations related to the effects of the PSA's efforts in the short term, and a better basis for assessing whether the agency is using resources in the most effective way.

It is also important to assess whether the supervisory work is effective in the longer term; that the work does indeed contribute to the achievement of the goals that the Storting set out in Prop. 1 S. Obtaining such information requires other measures such as evaluations and R&D. We have worked with this most recently through a multipartite working group in 2017, which provided useful feedback including insights regarding the effects of the PSA's work on an overarching level, and provided a basis for the development of the agency's efforts and use of sanctions.

Furthermore, I initiated a research project (2018–2020) that will examine how the use of sanctions affects the working environment. In the first instance, this will concern the effects of the Labour Inspection Authority's use of sanctions, but the results of such a project will also be able to provide useful information about the effects of sanctions in the working environment and about the orientation of measurements, and so forth, of supervision work and the use of sanctions in general.

Investigations of incidents and accidents are a key source of information about the course of events and underlying causes, and the PSA carries out annual investigations of incidents when this is deemed appropriate. This provides useful information that is used by the PSA in its follow-up of activities in order to promote education relating to future efforts to prevent accidents and incidents. Investigations can also be a tool for obtaining information relating to the authorities' follow-up, and the Ministry is working on an assessment of the existing scheme where an independent investigation can be initiated if needed.

Concerning the follow-up of cyber security
Cyber security is a key area that is continually gaining relevance, particularly in as technologically advanced and complicated a field as the petroleum industry. The Office of the Auditor General notes that the Ministry has not performed adequate follow-up of how the PSA handles its responsibility for cyber security, as stated in Section 9-3 of the Petroleum Act.

Cyber security is a broad concept. In the petroleum industry, it is common to distinguish between ICT systems that control industrial processes on the one hand, and office suites on the other. The PSA's responsibilities include ICT systems that control industrial processes, but not office suites. However, the authority defines its responsibility in such a way that it also includes the barriers between the industrial systems and the office suites.

Cyber security is not a new subject in the petroleum industry. ICT solutions have long controlled numerous industrial processes within the industry. Cyber security has therefore also long been

integrated into the functional requirements of HSE regulations and is a natural subject for PSA follow-up. For example, the HSE regulations' functional requirements for barrier control, risk reduction and acceptance criteria for risks of major accidents will be just as relevant for cyber security as for an issue like well integrity.

In such contexts, the management dialogue and information about HSE, risks of major accidents and deliberate attacks have also included cyber security to a substantial degree, even if the wording did not explicitly mention the concept of cyber security. For example, typically ICT-heavy areas like integrated operations and remote control have several times been a subject of discussion in the formal management dialogue. The PSA received additional appropriations in 2007/2008 in connection with strengthened follow-up in the area of integrated operations.

I am otherwise in agreement with the Office of the Auditor General that follow-up of the industry's cyber security is an important area for the PSA. In the PSA's experience, the industry is, to an increasing extent, making use of digital solutions in the areas of integrated operations, remote control, automation, robotics, artificial intelligence and access to computing power that facilitates the analysis of large amounts of data. The Ministry of Labour and Social Affairs has therefore in recent years set cyber security as a separate item on the management dialogue agenda and holds two informational meetings annually in which cyber security is the main topic. cyber security is followed up both through separate supervision and as a component in broader supervision, which has both an HSE perspective and the perspective of protection against deliberate attacks. Appropriations for the PSA were last increased in 2018 in order to support follow-up in this area.

The Office of the Auditor General's recommendations

The Office of the Auditor General recommends that the Ministry:

- Ensures that the PSA performs more risk-based verification that regulatory nonconformities are rectified and that orders are complied with

- Ensures that the PSA makes use of the available sanctions against companies for which this is necessary, and escalates the use of more severe sanctions as needed

- Develops a more relevant method of measuring the results and effects of the authority's activities that covers the need for management information

- Ensures that the PSA improves its follow-up on cyber security in petroleum activities

Regarding the first and second points:
The PSA will clarify and expand its supervision strategy and use of sanctions, see also Report to the Storting 12 (2017–2018). The authority's use of sanctions and the need for strong and clear supervision is part of this. This development work will be followed up through the agency management dialogue. Supplemental letters of commitment have been sent to the PSA as a follow-up to the report. Furthermore,

an investigative project has been initiated to assess challenges and measures for improvement following several construction projects, including the construction of Goliat.

Regarding the third point:
The PSA's efforts to measure the effects of supervision will be carried out through relevant development tasks, including user surveys, feedback from external working groups and the current research project. In combination with the authority's own supervision experience and information from RNNP and investigations, this provides a solid foundation for analysis and assessments relating to effects and resource use. The Ministry emphasises the importance of developing a satisfactory foundation of facts that can shed light on the effects of the PSA's activities, and will follow up on this in the agency management dialogue.

Regarding the fourth point:
The Ministry continues to use the agency management dialogue to follow up on cyber security, which is a key area for the PSA. The use and results of increased appropriations for the area are part of this.

Yours sincerely,

Anniken Hauglie

The document has been signed electronically and therefore has no handwritten signatures

Appendix 3

Report: The PSA's follow-up of health, safety and environment issues in the petroleum industry

The investigation was conducted in accordance with the Office of the Auditor General Act and instructions, and in accordance with the guidelines for administration audits, which are consistent with and build on ISSAI 300, INTOSAI's international standards for administration audits.

Contents

Summary of tables

Overview of figures

Summary of fact boxes

Glossary and abbreviations

Acknowledgement of Compliance (AoC)	A statement issued by the PSA acknowledging that a mobile offshore unit's technical condition and the applicant's organisation and management systems are in compliance with the relevant requirements of the Norwegian continental shelf regulations.
Annular preventer	Part of the BOP that closes the annulus to prevent the outward flow of gas and fluid.
Annulus	The ring-shaped space between the different casings that protect a petroleum well from the bedrock, between the casing and production tubing, and between the drill string and casing.
Audit	A planned, systematic review of components of a given company's management system. Interviews and the reviewing of documentation are typical methods for investigating whether the system that is described is in alignment with reality, and whether the system provides an adequate basis for sound operation.
Barriers	Measures with the aim and function of either preventing a specific series of events from taking place or of influencing a series of events in a deliberate direction by limiting damages and/or losses. The function of these barriers is performed by technical, operational and organisational elements, either individually or as a whole. An example of a technical barrier would be sensors that measure the pressure in a well.
Blowout	Formation fluid that flows out of the well or between the formation layers following the failure of all defined well barriers or operation thereof.
BOP	Blowout preventer, a large, specialised valve that is connected to the wellhead to seal, control and monitor the well to prevent blowouts.
Christmas tree	Pipes and valves installed on the wellhead.
Company with major accident prevention obligations	A company that stores or handles dangerous chemicals that pose health, environmental, fire or explosion risks.
Consent	A decision expressing the authorities' trust that the operator can carry out its activities within the guidelines of the regulation(s) and in accordance with the information provided in the application for consent. The operator must obtain the authorities' consent at key milestones in order to continue its activities.

Corrosion under insulation	The phenomenon of corrosion that occurs on insulated surfaces such as pipes. Time-consuming and costly maintenance challenges that cannot be identified visually, but require stripping or special methods of inspection.
Cuttings injection	Crushed stone mass (sediment mass) that is removed from the borehole as the well is drilled. The drilling waste is transported out of the borehole with drilling fluid (drilling mud).
Deep-set plug	Barrier inserted into the wellhead upon removal of the tubing hanger.
Drilling programme	A description containing well- and wellbore-specific information about planned drilling and well activity.
Innretning	Installasjoner, anlegg og annet utstyr for petroleumsvirksomhet, likevel ikke forsynings- og hjelpefartøy eller skip som transporterer petroleum i bulk. Innretning omfatter også rørledning og kable når ikke annet er bestemt.
Drilling rig	Derrick, necessary machinery and additional equipment used in drilling for oil or gas on land or from a drilling platform at sea.
Ex equipment	Electrical components that are constructed in such a way that flammable gas present in the equipment's location cannot be ignited by said equipment.
Extraction licence	Licence granting exclusive rights to investigation, exploratory drilling and extraction of petroleum deposits within the given geographic area of the licence. The licensees become owners of the petroleum that is produced. An extraction licence can include one or several blocks or portions of blocks and regulates the participating companies' rights and obligations to the State.
Facilities	Installations, platforms and other equipment used in petroleum activities, though not platform supply or support vessels or ships that transport petroleum in bulk. Facilities also include pipelines and cables unless otherwise noted.
FCV	Flow control valve.
Field	One or several deposits that licensees have decided to develop, and for which the authorities have either approved PDO or granted a PDO exemption.
FPSO	Floating Production, Storage and Offloading, a floating unit used for processing and storing petroleum in production on an oil field. The oil is regularly unloaded to a tanker for transport to land. Goliat is an example of an FPSO.
GLV	Gas lift valve.

Hydrocarbon leak	Hydrocarbon leaks can be divided into three categories: gas leaks, fluid leaks and multiphase leaks (oil/gas). Gas leaks have the greatest potential to cause damage due the risk of explosion as gas clouds spread.
Integrated operations	An umbrella term used in the petroleum industry to denote new forms of operation, work processes and methods made possible by the adoption of ICT. For instance, the management from land of operations at sea.
Licensee	A physical or legal person, or several such persons, who according to the Petroleum Act or previous legislation holds a licence for investigation, extraction, transport or exploitation. If a licence is granted to several such persons as a group, the term “licensee” can include both the group of licensees as a whole and the individual participants.
Major accident	An acute incident, for example a substantial leak, a fire or explosion that either immediately or in its aftermath causes multiple serious personal injuries and/or fatalities, serious damage to the environment and/or loss of significant financial assets.
Mobile offshore unit	A facility that is registered in a national ship registry (flagged facility) and must therefore follow a maritime operational conceptincluding classification, for example drilling platforms and well intervention facilities.
Nonconformity	Unsatisfactory fulfilment of (regulatory) requirements.
Operator company (operator)	A company that has the right to search for oil and gas in a given block and construct a field for production in the event of commercial findings. The operator can act on behalf of a partnership of several companies.
Petroleum activities	All activities related to subsea petroleum deposits, including investigation, exploratory drilling, extraction, transport, exploitation and cessation, as well as the planning of such activities, though not including the transport of petroleum in bulk by ship.
Plugging (of a well)	Securing a well when installing well barriers. The well barriers can consist of cement plugs, mechanical plugs or a combination of the two. There is a distinction between temporary plugging, where there are plans to reconnect the well in the future, and permanent plugging, where the well is abandoned permanently.
Production tubing	Tubing that carries oil and gas from the reservoir to the platform. This is connected to a tubing hanger on the wellhead.

RNNP	Abbreviation for Norwegian “Risikonivå i norsk petroleums-virksomhet” (Trends in risk level in the petroleum activity). RNNP is a measurement tool that shows the development of the risk level on the Norwegian continental shelf. RNNP is based on various data sources, both quantitative and qualitative.
System audit	Systematic investigation of management and control system, review of quality system or parts thereof, to assess how the system is followed.
Tubing hanger	A device installed on the wellhead or Christmas tree to attach the production tubing to the well. This also seals the annulus.
Verification	Physical, on-site investigations in connection with supervision with the purpose of ascertaining whether the factual conditions are in alignment with the regulations.
Well	A hole that is drilled to find or delimit a petroleum deposit and/or to produce petroleum or water for injection purposes, to inject gas, water or another medium, or to survey or monitor well parameters. A well can consist of one or several wellbores and can have one or several endpoints.
Well control incident	Flow of formation fluids into a well, resulting in pressure build-up in a closed BOP, following a positive flow check. A well kill method is determined and executed.
Wellhead	The equipment (outlet, valves, etc.) attached to the top of a well to prevent blowouts.
Winterisation	Preparation of facilities with equipment and workplaces so that they can operate normally even in areas with a harsh winter climate.

1 Introduction

1.1 Background

Petroleum is by far Norway's largest industry in terms of value creation, government revenue, investments and export value. The State's net cash flow from the industry was estimated at 224 billion NOK for 2018.[1] This figure includes tax revenue, the State's cash flow from direct ownership interests in the field through the State's direct financial involvement in petroleum activities, dividends from Equinor,[2] and excise duty.

Petroleum activities entail a risk of major accidents that could have significant consequences for people, the environment and material assets. These activities must therefore be carried out in a prudent manner and in accordance with the applicable regulations as stated in Section 10-1 of the *Act 29 November 1996 no. 72 relating to petroleum activities* (Petroleum Act). Authorities, industry players and the Standing Committee on Labour and Social Affairs have agreed that a central aim should be for Norwegian petroleum activities to be first-class with regard to HSE; see Innst. 385 S (2017–2018) *Innstilling fra arbeids- og sosialkomiteen om helse, miljø og sikkerhet i petroleumsvirksomheten* (Norwegian only).

The Petroleum Safety Authority (PSA) is governed by the Ministry of Labour and Social Affairs and has regulatory responsibility for the working environment and safety in petroleum activities; see Prop. 1 S (2017–2018) *Ministry of Labour and Social Affairs.* Participants in petroleum activities are responsible for ensuring that their activities are carried out in a prudent manner at all times. The primary task of the PSA is, through supervision and other available tools, to influence, follow up and make it possible for entities to fulfil this responsibility. The PSA must actively assess whether the use of sanctions, including notification of orders, issuance of orders and reports, helps to ensure that activities are conducted in compliance with regulatory requirements.

HSE developments in the Norwegian petroleum industry since the year 2000 have been positive.[3] The number of serious incidents that could lead to major accidents has decreased over time. The PSA's tool for measuring the trends in risk level in the petroleum activity (RNNP) showed that the major accident indicator, which reflects the number of serious incidents and their potential for loss of life, reached a low level in 2013 and 2014, but was higher in 2015 and 2016. In 2017, the major accident indicator returned to the same level as in 2013 and 2014. In recent years, the petroleum industry has been experiencing a challenging period of extensive change and transition. Working environment standards in the petroleum industry have had a mainly positive development, but the industry still faces numerous working environment challenges. The survey carried out in connection with RNNP in 2015 and 2017 identified challenges in the areas of psychosocial working environment, culture of security and reporting culture, and there was an increase in the number of serious personal injuries in 2017. In the past ten years, there have been four fatal accidents in the Norwegian petroleum industry. In the period 2015–2017 there were two fatalities, a very serious well control incident on the Troll gas field and several other serious incidents investigated by the PSA. The number of serious incidents related to well control and hydrocarbon leaks increased in 2015 and 2016.

1) Report to the Storting 2 (2017–2018) *Revised National Budget 2018*.
2) Statoil changed its name to Equinor on 15 May 2018. The name Equinor is used throughout the report, but Statoil is used where sources or mentions predate 15 May 2018.
3) Petroleum Safety Authority (2018) Sammendragsrapport — *Risikonivå i norsk petroleumsvirksomhet 2017* (Norwegian only)

Following several serious incidents in 2016, the Ministry of Labour and Social Affairs decided to invite the parties involved to evaluate and discuss the situation. The government also announced a new white paper regarding safety on the Norwegian continental shelf and a full review of the industry's HSE conditions.[4] Report to the Storting 12 (2017–2018) *Health, safety and environment in the petroleum industry* was presented before the Storting on 6 April 2018 and was considered by the Ministry of Labour and Social Affairs on 5 June 2018.[5]

A comprehensive questionnaire-based survey conducted in 2017 among workers on the Norwegian continental shelf and on the onshore production facilities shows that indicators relating to HSE conditions are seen as generally worse in 2017 compared with 2015.[6] The number of reports of concern submitted to the PSA increased significantly in the period 2015–2017, particularly the number of reports concerning organisation and working environment.[7]

The landscape of the petroleum industry on the Norwegian continental shelf has changed significantly. There is a greater variety of players. In 1999, 12 companies were operators. In 2017, the number of operators had increased to 27, of which 13 were operators for producing fields.[8] In recent years, several large, international companies have removed themselves either completely or partially from the Norwegian continental shelf, and several mergers and acquisitions have taken place. The number of mid-size companies has increased, but Equinor's role as the largest company remains unchanged, with operatorship of approximately 70 per cent of Norwegian oil and gas production. According to Report to the Storting 12 (2017–2018) *Health, safety and environment in the petroleum industry*, Equinor is, because of its position, essential to the HSE level of the industry and is of great importance to activities on the Norwegian continental shelf overall.

The price of oil fell in 2014, and for a long time remained at around 50 USD per barrel. During this period, companies were therefore under pressure to reduce costs for maintenance, operations and future construction. This led to an urgent need for restructuring in the companies, increased demands for efficiency and pressure on the collaboration between authorities, employers and trade unions. Both trade unions and the PSA were concerned about the effects of downsizing and budget cuts on HSE standards in the petroleum industry.[9]

In 2013 a specialist group appointed by the Ministry of Labour and Social Affairs pointed out a need for clearer prioritisation and use of sanctions by the PSA.[10] The assembled working group that delivered its report in autumn 2017 was also in agreement about the necessity for a strong and clear supervision process.[11] The groups held a range of views on whether the trust-based strategy of supervision is appropriate given the current situation in the industry.

4) *Minister Hauglie announces new white paper on petroleum safety*. <https://www.regjeringen.no/en/aktuelt/minister-hauglie-announces-new-white-paper-on-petroleum-safety/id2521940/> https://www.regjeringen.no/en/aktuelt/minister-hauglie-announces-new-white-paper-on-petroleum-safety/id2521940/> [28 August 2018].
5) Innst. 385 S (2017–2018) *Innstilling fra arbeids- og sosialkomiteen om helse, miljø og sikkerhet i petroleumsvirksomheten* (Norwegian only).
6) Petroleum Safety Authority (2018) *Sammendragsrapport — Risikonivå i norsk petroleumsvirksomhet 2017* (Norwegian only).
7) Petroleum Safety Authority (2017) Annual Report 2016.
8) Norwegian Petroleum Directorate (2017) *2017 Resource Report for Fields and Discoveries*, 25 August; Norwegian Petroleum Directorate (2016) *Petroleum resources on the Norwegian continental shelf 2016*, 4 May.
9) Ministry of Labour and Social Affairs (2017) *Health, safety and working environment conditions and trends in the Norwegian petroleum industry;* Stavanger Aftenblad, online edition 29 April 2017: *Ptil-direktøren advarer mot følger av kostnadskutt* (Norwegian only).
10) Ministry of Labour and Social Affairs (2013) *Tilsynsstrategi og HMS-regelverk i norsk petroleumsvirksomhet* (Norwegian only).
11) Ministry of Labour and Social Affairs (2017) *Health, safety and working environment conditions and trends in the Norwegian petroleum industry — Report from a working group.*

The trade unions questioned whether the supervisory process has sufficient authority in all instances, and whether the sanctions are used adequately, especially in repeated findings of undesirable conditions. In Report to the Storting 12 (2017–2018), the government states that the PSA must be a strong and clear authority and must actively and visibly evaluate its use of sanctions. According to the government, this development indicates that the PSA must, in some situations, be clearer in its use of sanctions and make greater effort to ascertain that nonconformities and orders are followed up on.

1.2 Objectives and issues

The aim of the investigation is to assess whether the Petroleum Safety Authority's supervisory practices protect health, safety and the environment in connection with petroleum activities in accordance with parliamentary decisions.

The investigation addresses the following questions:

1. How do the PSA's supervision methods and use of sanctions work?
   - 1.1 To what extent do the PSA's supervision methods help to uncover real HSE challenges?
   - 1.2 To what extent does the PSA's use of sanctions encourage companies to rectify nonconformities?
2. To what extent does the PSA follow up on incident reporting and reports of concern?
3. To what extent does the PSA's processing of applications ensure that consent is granted with proper justification?
4. How does the Ministry of Labour and Social Affairs facilitate the PSA's efforts to ensure health, safety and environment standards in the petroleum industry?

The PSA is involved with the entire life cycle of a petroleum project — from the opening of an area through the issuance of an extraction licence, the exploratory phase, development and operation, to the termination of the field. The PSA defines supervision as encompassing all dialogue and contact with companies, not only the activities that result in audit reports published on the authority's website.

The investigation does not concern the PSA's role in the opening of areas and issuance of extraction licences. The starting point is the authority's follow-up of whether the companies are carrying out petroleum activities in a prudent manner after an extraction licence has been issued. The scope of the investigation is limited to the legal responses that the authority has at its disposal, and focuses to a lesser extent on non-codified responses such as dialogue and meetings. The scope of the investigation is limited to the results of supervision in the form of audit reports, follow-up of incidents and reports of concern, and the processing of applications for consent.

The investigation primarily covers the years 2013–2017, but includes some information from before 2013, such as results of supervision and investigative reports.

2 Methodology and implementation

In order to answer the questions of the investigation, we have conducted interviews with relevant parties, document reviews, analyses of quantitative data and a case review of reports of concern to the PSA. We have also conducted case studies of four facilities/platforms and of the PSA's follow-up of these in general and before/after the incidents occurred. Assistance was also obtained from external specialists to ensure a strong professional understanding of safety-related questions and the PSA's responsibility as an authority. The specialists are Knut Kaasen, a professor at the Scandinavian Institute of Maritime Law at the University of Oslo, and Jan Erik Vinnem, a professor in the Department of Marine Technology at the Norwegian University of Science and Technology.

2.1 Interviews

In order to answer all the questions of the investigation, interviews were conducted with the following parties:

- Petroleum Safety Authority
- Ministry of Labour and Social Affairs
- representatives from trade unions (Industri Energi, SAFE, Tekna, NITO, Lederne)
- representatives from employer associations (the Norwegian Shipowners' Association and Norwegian Oil and Gas)
- companies (Equinor Energy AS, Eni Norge AS, AS Norske Shell, Songa Offshore)[12]
- other authorities (the Norwegian Environment Agency, the County Governor of Rogaland)

The interview subjects were selected because they represent central interests and parties in the work on HSE in the petroleum industry. Key employer associations and trade unions were interviewed in addition to the PSA and the Ministry of Labour and Social Affairs. It was essential to the completion of the case studies to interview companies and trade unions that are familiar with the HSE work at the selected facilities and platforms. Because industry players have varied viewpoints on several issues, the interview data from meetings with authorities, companies and trade unions has been verified through the case studies, document review, analysis of quantitative data and/or in the review of the authority's follow-up of incident reporting and reports of concern. Furthermore, interviews are used to ensure that the relevant parties' perspectives on the central questions of the investigation are taken into account when addressing the different audit problems.

The interviews were conducted in the period from November 2017 to June 2018. All interview minutes have been verified and represent the statements of the respective bodies and actors.

12) During the investigation, Songa Offshore was acquired by Transocean and ceased operating as an independent company on 28 March 2018. Nevertheless, the name Songa Offshore is used in the investigation because the incident and the interview with the company took place before the takeover.

2.2 Case studies

To answer questions 1–3, four case studies were conducted. With the help of the case studies, it is possible to thoroughly follow the PSA's supervisory practices and follow-up and handling of specific incidents and reports of concern. The preparation of the individual case studies involved document review, interviews with relevant parties and analysis of incident statistics, reports of concern, investigative reports and audit reports.

The PSA's supervision is risk-based. This means that it is oriented towards entities or facilities where HSE conditions are the most challenging, and where the PSA's efforts are expected to have the greatest effect. The case studies were therefore selected based on risk and significance. Facilities and platforms that, for various reasons, have had a particular need for follow-up from the PSA were chosen. The facilities and platforms selected for case studies cover the range of the PSA's area of responsibility. The PSA follows how the companies address HSE at production facilities, drilling rigs and onshore production facilities. We therefore selected one production facility, one drilling rig and two onshore production facilities. The basis for the selection of the four case studies includes information about supervisory activities and their results, serious incidents, investigations and interviews from the preliminary investigation.

- **Goliat** is the first permanently placed floating production facility in the Barents Sea. The operator of the field is Eni Norge AS. Goliat was given high priority by the PSA. According to the PSA, more supervisory activities were carried out during this construction than normal, and Goliat is the construction project that was subject to the most sanctions from the authority in recent decades. The case study of Goliat helps to explain the PSA's follow-up of a field under development, from the project engineering and construction phase to the initiation of production and operations. There were many incidents on the platform, many regulatory breaches, and production was shut down about half of the time it was in operation due to errors and gas leaks. The study examines supervisory practices, the use of sanctions, the handling of reports of concern and the processing of applications for consent.

- **The incident on the drilling rig Songa Endurance** in autumn 2016 was one of the most serious well control incidents to occur on the Norwegian continental shelf since the Snorre A incident in 2004. The case study investigates how the PSA follows up serious incidents, in this case a serious well control incident. The study also investigates how the PSA followed up previous serious well control incidents and gas leaks where Equinor was the operator.

- The **Nyhamna** onshore production facility for processing and distribution of gas is operated by Shell Norge AS. Numerous incidents have occurred at the facility. Of all onshore production facilities, Nyhamna has been subject to the most supervision from the PSA in the period 2013–2017. The facility has also found itself in the media spotlight due to a report of concern about an unacceptable working environment and difficult working conditions for the safety officers. The case study of Nyhamna provides the opportunity to assess the PSA's supervisory practices concerning onshore production facilities, follow-up of incidents and reports of concern, and follow-up of working environment issues.

- The **Mongstad** onshore production facility for receiving and refining oil and gas in Hordaland is operated by Equinor. After Nyhamna, Mongstad was the onshore production facility to receive the most supervision from the PSA in the period 2013–2017. Several incidents have occurred at the facility. A serious gas leak with the potential for a major accident occurred in 2016, while an cyber security incident

occurred in 2014. The 2016 gas leak was caused by corrosion under insulation, which is generally a challenge in older petroleum facilities both on land and at sea. Over time, there have been several serious incidents related to corrosion under insulation at the facility. There have also been a relatively high number of incident reports and reports of concern from the facility relating to corrosion under insulation and maintenance work. The case study therefore provides grounds on which to evaluate the supervisory practices and how the authority follows up on serious incidents, incident reports and reports of concern. Mongstad also provides an opportunity to evaluate how the PSA follows up on cyber security in the petroleum industry. The incident in 2014 is one of very few publicly known cyber security incidents in the petroleum industry. The PSA carried out supervision of cyber security at Equinor after the fact. The incident therefore provides an opportunity to evaluate the PSA's supervisory practice in this area and how the authority followed up on cyber security at Equinor.

2.3 Analysis of quantitative data

In order to answer question 1, we obtained relevant statistics and reporting from the period 2013–2017, and to answer question 2 we obtained numerical data with an overview of incident reports and reports of concern. This data includes the PSA's statistics for reportable incidents, overview of reports of concern and a database of the PSA's publicly available audit reports with an overview of completed supervisory activities, with nonconformities and improvement points.

We obtained an overview of all reportable incidents reported to the PSA in the period 2011–2017. The incident statistics are used for the case studies, among other things. Furthermore, we obtained an overview of all reports of concern received by the PSA in the period 2007–2017. The overview is used to establish a comprehensive image of the types of reports of concern the PSA receives, and is used in the preparation of the case studies.

A database of the PSA's audit reports was compiled in order shed light on question 1. The database was constructed using the PSA's publicly available supervision and investigative reports and was developed based on a database compiled by DNV GL on the request of Norwegian Oil and Gas and the Norwegian Shipowners' Association. DNV GL's database contained several misclassifications and was not exhaustive with regard to completed audits and verifications financed by penalties in the period 2013–2017. Because an exhaustive overview of results from completed audits and verifications financed by penalties was required, the database was expanded and quality assurance was conducted.

Information from supervision carried out in 2017 and from supervision of onshore production facilities was not part of the database and was therefore added. The Office of the Auditor General performed quality assurance of the database contents.

The PSA distinguishes between supervision financed through sector fees and audits/ verifications financed by penalties. All supervision financed by sector fees was removed from the database with assistance from the PSA.

The supervision database contains 582 audit reports, with information regarding the company, facility/platform, year, date of the audit report, participants, nonconformities, improvement points, the legislative basis for nonconformities and improvement points,

and categories/subject of the supervision. The categories were developed by the Office of the Auditor General following dialogue with the PSA. All supervisory activities and nonconformities are categorised. The categories are identified on the basis of title, goal formulation, contents of audit reports, legal references and the specialisations of the supervision participants.

2.4 Document review

The audit carried out a document review to address all four questions. The analysis was focused primarily on the following types of documents:

- The PSA's internal procedures and guidelines for handling and following up on reported incidents, receipt and follow-up of reports of concern
- Procedures and requirements for the processing of cases involving consent
- Basic documentation for the processing of consent
- Procedures for sampling and completion of supervision, creation of audit reports and use of sanctions
- Documentation from the PSA's archive that helps to elucidate supervision and use of sanctions in the four case studies
  - Correspondence with the companies in connection with supervision, consent, reports of concern, incidents, etc.
  - Minutes from meetings and presentations given in meetings
  - Reports prepared by the companies
- Forskningsrapporter

The audit had direct access to the PSA's archive. A review was conducted of archived documentation of the PSA's follow-up of facilities and platforms that were chosen for case studies. This access was also used for analysis of agency management and management dialogue with the Ministry of Labour and Social Affairs.

Letters of commitment, minutes from agency management meetings and annual reports were reviewed in order to evaluate the management of the PSA by the Ministry of Labour and Social Affairs.

2.5 Case file review of reports of concern

To investigate the PSA's follow-up of reports of concern, all cases involving reports of concern received in the period 2015–2017 were reviewed. In addition, all cases involving reports of concern relating to the four case studies were included, even if they were reported prior to 2015. This meant a total of 95 cases. Information about the cases was entered in an analysis model with criteria based on the Working Environment Act, the Freedom of Information Act and the PSA's own procedures for processing reports of concern. The review was based on the information documented in the PSA's archive system, ePhorte. The information contained in ePhorte must document the case proceedings. It is publicly available in accordance with the Freedom of Information Act and applications for access can be made. Therefore, the information in ePhorte is the official and public documentation of how a report of concern is processed by the PSA.

The PSA has its own case processing system, called "Planverktøyet", which contains information beyond that which is considered worthy of archiving. This system states whether a report of concern has, for instance, been followed up with supervision, which

is not always visible in ePhorte. To investigate how the PSA has actually processed and followed up on reports of concern, the review of information in ePhorte was submitted to the PSA so that they could supplement it with information from Planverktøyet relating to how reports of concern are followed up. Information in Planverktøyet is internal and therefore not public. Information from this system is therefore not included in the official documentation.

2.6 Control of the PSA's compliance with internal control regarding the competence of employees

There are requirements for competence and integrity on the part of PSA employees that will help to ensure the authority's independence. In order to investigate whether the employees are in compliance with the competence requirements, employees' share ownership and compliance with quarantine regulations have been examined. All employees who participated in supervision activities in the period 2013–2017 were checked against the shareholder register as of 31 December 2017. This is to investigate whether employees own shares in companies that are subject to supervision by the PSA. Furthermore, the employees' previous working relationships were checked against the employee and employer registry. Following employment by the PSA, information regarding previous working relationships is compared with information from the supervision database, where it states which companies the employees conduct supervision of. This is done to ensure that the PSA upholds the quarantine regulation stating that new employees cannot carry out supervision of or be involved in decisions relating to a previous employer.

3 Audit criteria

3.1 Overarching requirements for health, safety and environment in the petroleum industry

Section 10-1 of the Petroleum Act requires that petroleum activities be conducted in a prudent manner and in accordance with the applicable regulations for such activities. The activities must protect the safety of the staff, the environment and the financial assets represented by facilities and vessels, including operational availability. Under the Petroleum Act, the authorities are responsible for carrying out supervision to ensure that the provisions stated in or pursuant to the law are upheld by all who participate in petroleum activities within the scope of the law.[13]

The Standing Committee on Labour and Social Affairs emphasises the aim for the Norwegian petroleum industry to be world-class in terms of health, safety and environment; see Innst. 333 S (2011–2012). The committee refers to the main principle of Norwegian HSE policy, which is that the responsibility for safe operations and emergency preparedness is placed on the industry itself. The authorities' primary strategy is to hold participants accountable so that they continuously act prudently and in accordance with applicable regulations. In connection with the consideration of Prop. 1 S (2016–2017) *Ministry of Labour and Social Affairs,* see Innst. 15 S (2016–2017), the Standing Committee on Labour and Social Affairs highlights the importance of safety efforts on the Norwegian continental shelf, as well as the importance of a strong and visible supervision authority for preserving a high level of safety on the shelf. The Standing Committee on Labour and Social Affairs notes that the PSA must lay the groundwork for and follow up to ensure that participants in the petroleum industry maintain a high level of HSE.

In Report to the Storting 29 (2010–2011) *Joint responsibility for a good and decent working life* (see Innst. 333 S (2011–2012)) the government states that a tripartite collaboration in the petroleum industry is developed in the Norwegian working environment between authorities, employers and workers. Open communication and mutual recognition of roles and responsibilities are fundamental principles of the collaboration. Furthermore, the government notes that employee participation is required in order to operate sound petroleum activities in Norway, and that this must be done at all phases of said activities. It is further noted that participation is particularly crucial in an industry with a risk of major accidents, because the employees may have important expertise and experience that provides the industry with an even better basis for making decisions regarding HSE.

3.2 The authorities' responsibilities

The Ministry of Labour and Social Affairs has overarching regulatory responsibility for safety, preparedness, working environment and safeguarding in the petroleum industry, and for ensuring that this is done in accordance with parliamentary decisions.[14] This entails a responsibility to contribute to continuous improvement of safety and the

13) *Act relating to petroleum activities* (Petroleum Act) Section 9-3.14)
14) Report to the Storting 29 (2010–2011), see Innst. 333 S (2011–2012).

working environment. The Ministry is also responsible for agency management of the PSA.

The PSA's regulatory responsibility is stated in Crown Prince's resolution of 19/12/2003. The PSA has the operational regulatory responsibility for safety, preparedness and the working environment in the petroleum industry, including petroleum facilities and associated pipeline systems.[15] The PSA must

- maintain regulatory responsibility for technical and operational safety, including preparedness, and for the working environment at all stages of petroleum activity, including planning, project engineering, construction, operations and eventual removal;
- lay the groundwork and follow up to ensure that participants in the petroleum industry maintain a high standard of health, safety, environment and preparedness. The follow-up must be system-oriented and risk-based;
- carry out supervision of safety, preparedness and the working environment and perform the role of coordinating authority for the HSE authorities of the petroleum industry;
- conduct informational and consulting activities for participants in the industry;
- ensure that the petroleum industry and related activities are followed up in a comprehensive manner.[16]

The regulatory responsibility also encompasses civil protection and preparedness against and prevention of deliberate attacks; see Prop. 1 S (2016–2017) for the Ministry of Labour and Social Affairs.

A key principle within HSE is that the responsibility for preventive security and preparedness lies with the companies themselves. However, supervision to ensure that the companies follow up on their responsibility for safety and the working environment is the responsibility of an authority.[17] In other words, the PSA is not directly responsible for the state of HSE in the petroleum industry, but it is responsible for carrying out supervision to verify that the companies follow up on the requirements set out by regulations or decisions. The industry's responsibility is to ensure a fully sound working environment in line with applicable regulations.[18] The workers also have a right and an obligation to contribute to the establishment of a safe and inclusive working environment.[19]

3.3 Requirements for the PSA's follow-up of health, safety and environment in the petroleum industry

During the consideration of Report to the Storting no. 12 (2005–2006) Health, safety and environment in the petroleum industry, the Standing Committee on Labour and Social Affairs stated that it is desirable to have strict HSE regulations, and for these to be enforced so that the risk of personal injury and illness is kept as low as possible. The Committee noted that it is essential for the enforcement of the regulations to be consistent and predictable.[20] The PSA has been delegated with the task of setting

15) The eight onshore production facilities are: Melkøya, Tjeldbergodden, Nyhamna, Kollsnes, Mongstad, Sture, Kårstø and Slagentangen.
16) *Vedtak om opprettelse av Petroleumstilsynet* (Norwegian only), see Crown Prince's resolution of 19 December 2003.
17) Report to the Storting no. 17 (2002–2003) Om statlige tilsyn (Norwegian only); see Innst. S. nr. 222 (2002–2003) Innstilling fra familie-, kultur- og administrasjonskomiteen om statlige tilsyn (Norwegian only).
18) *Regulations relating to health, safety and the environment in the petroleum activities and at certain onshore facilities* (Framework Regulations) Section 5.
19) *Act relating to working environment, working hours and employment protection, etc.* (Working Environment Act) Section 2-3.
20) Innst. S. no. 197 (2005–2006) *Innstilling fra arbeids- og sosialkomiteen om helse, miljø og sikkerhet i petroleumsvirksomheten* (Norwegian only).

detailed regulations for safety and the working environment for companies in the sector.[21]

Comprehensive and coordinated regulations have been developed for petroleum activities at sea and at certain onshore production facilities that are rooted in a number of laws; see Report to the Storting no. 12 (2005–2006). The regulations are based on the Petroleum Act, the Working Environment Act and other HSE legislation.[22] They are elaborated on in five regulations that apply to the PSA's area of responsibility:

- Framework Regulations — *Regulations relating to health, safety and the environment in the petroleum activities and at certain onshore facilities*
- Management Regulations — *Regulations relating to management and the duty to provide information in the petroleum activities and at certain onshore facilities*
- Activities Regulations — *Regulations relating to conducting petroleum activities*
- Facilities Regulations – *Regulations relating to design and outfitting of facilities, etc. in the petroleum activities*
- Technical and Operational Regulations — *Regulations relating to technical and operational matters at onshore facilities in the petroleum activities, etc*.

These regulations came into effect on 1 January 2011 and are enforced by the PSA, the Norwegian Environment Agency and the health authorities. The provisions of the regulations are formulated primarily as general functional requirements. Standards, norms and guidelines expand upon and specify the regulations' level of responsibility.

The PSA uses supervision and other tools to ensure that companies are operating in accordance with the regulations. Essential tools of the authority's collective supervision activities are[23]
- evaluation of the companies' HSE competence when issuing extraction licences
- approval scheme for applications for licences to carry out certain activities
- collaboration with the industry on regulation development, HSE research and more
- supervision of companies' management and follow-up of HSE in petroleum activities
- sanctions upon the discovery of regulatory breaches or insufficient follow-up
- knowledge sharing, counsel and guidance for the industry

The PSA uses different responses if breaches of the regulations are discovered. The sanctions must be reflective of the materiality and significance of the regulatory breach in question; see Prop. 1 S (2016–2017) for the Ministry of Labour and Social Affairs. In accordance with Section 72 of the Framework Regulations, the PSA has the following legal responses at its disposal:[24]
- orders
- coercive fines
- suspension of operations
- penalties for violations

Punishment and certain coercive measures fall under the expertise of other authorities, but in individual cases the PSA can assist in various ways such as reporting. With the exception of punishments, the tools are individual decisions. This means that the use

21) *Vedtak om opprettelse av Petroleumstilsynet* (Norwegian only), see Crown Prince's resolution of 19 December 2003
22) Acts under the PSA's jurisdiction: the Petroleum Act, the Working Environment Act, the Tobacco Control Act, the Fire and Explosion Prevention Act, the Electrical Supervision Act, the General Application Act and the Svalbard Act. Additionally, there are other laws managed by the environmental and health authorities: the Pollution Control Act, the Health Personnel Act, the Patients' Rights Act, the Communicable Disease Control Act, the Public Health Act and the Product Control Act.
23) Report to the Storting no. 12 (2005–2006) *Health, safety and environment in the petroleum industry*.
24) Framework Regulations Section 72; see Working Environment Act chapter 19 and Petroleum Act sections 10-13, 10-16 and 10-17.

of these tools must follow the processing routines and administrative regulations stated in the Public Administration Act and non-statutory administrative law.

The supervision must be risk-based, which is to say that the supervisory activities are aimed at the audit problems and companies for which the risk of undesirable developments is thought to be highest. The choice of instruments is based on the conditions of the sector in question and what will contribute to the most effective impact. It is also essential that the authorities' focus on and prioritisation of topics and challenges facing the working environment reflect the key challenges of the sectors and the activities in question; see Prop. 1 S (2016–2017) for the Ministry of Labour and Social Affairs.

In order to reduce the risk of major accidents in the petroleum sector, Prop. 1 S (2009–2010) emphasises the importance of increasing knowledge about the risk factors involved with petroleum activities, so that the participants are equipped to implement goal-orientated measures.

A key measure towards this aim was to continue and expand the foundational data for the project Trends in risk level in the petroleum activity (RNNP). RNNP will help to establish a unified understanding of the risks facing the petroleum industry, both on the Norwegian continental shelf and on land.

3.4 Requirements for the processing of applications for consent

According to Report to the Storting 29 (2010–2011), consent to begin activities is a crucial milestone in the development and operation of a field. Section 29 of the Framework Regulations gives the PSA the option to determine, through regulations or decisions, that the operator must obtain consent from the PSA before initiating certain activities. This is done through Section 25 of the Management Regulations, which describes which activities require consent. These include the initiation of exploratory drilling, the initiation of operation and production, and the removal of installations from a field upon cessation. The operator submits an application to the PSA for consent. Consent is granted if the PSA is confident that the operator can execute the planned activities in a prudent manner within the framework of HSE regulations and in accordance with the information provided in the application. If the conditions for consent granted pursuant to Section 25 of the Management Regulations are changed significantly, the PSA can require the operator to reapply for consent before continuing the activities. The requirements for the contents of an application for consent are stated in Section 26 of the Management Regulations. The PSA does not grant consent until all relevant licences and statements have been issued.[25] Consent is a decision and must follow the Public Administration Act's overall requirements for competence, investigation and general management practice.[26]

The PSA issues Acknowledgements of Compliance (AoCs) following applications from those responsible for the operation of mobile offshore units that are registered in a national ship registry. An exception is if the operator is responsible for the operation of the unit; see Section 25 of the Framework Regulations. The application must contain information regarding the unit's technical condition and the applicant's organisation and relevant management systems. It must also include a statement regarding the application from the trade unions or their representatives.

25) Petroleum Safety Authority (2017) *Guidelines regarding the Management Regulations*, last updated 18 December 2017, Section 26.
26) *Act relating to procedure in cases concerning the public administration* (Public Administration Act).

The acknowledgement of compliance must be included in the documentation for an application for consent to use mobile offshore units; see Section 26 of the Management Regulations.

3.5 Requirements for incident reporting and reports of concern, and the PSA's follow-up of such reports

3.5.1 Companies' incident reporting and the PSA's follow-up

According to Section 29 of the Management Regulations, companies must ensure coordinated and immediate notification by telephone to the PSA in the event of accidents and emergencies that have resulted in fatalities or acute and serious injury or illness, acute contamination or serious impairment of safety-related barriers or functions at facilities. The notice must be confirmed with a written report to the PSA. In the event of accidents and emergencies that are less serious or less acute in nature, the operator must submit a report to the PSA on the first business day after the situation occurred or was discovered.

According to Section 30 of the Management Regulations, companies must keep the supervisory authorities updated on the development of the situation and what measures they plan to take, until serious or acute accidents and emergencies are neutralised. Prior to the completion of neutralisation measures, the supervisory authorities must be notified.

According to the guidelines regarding Section 29 of the Management Regulations, the PSA must forward written confirmation of notices of serious or acute incidents to the Norwegian Coastal Administration, the Norwegian Environment Agency, the Norwegian Board of Health Supervision, the Norwegian Directorate for Civil Protection and other relevant authorities.

The responsible party,[27] which is to say the operator or others who participate in the activities, must register and investigate incidents that have contributed to or could contribute to acute contamination or other damage. The aim is to prevent reoccurrence. Situations that occur frequently, or that have significant real or potential consequences, must be investigated by the responsible party.[28]

In the event of personal accidents that have resulted in fatality, serious personal injury, inability to work (with leave) or medical treatment, the employer must send a written notice to the PSA; see Section 31 of the Management Regulations.

Damages and incidents relating to load-bearing structures and pipeline systems must, in accordance with Section 36 of the Management Regulations, be reported by the operator in the PSA's database Corrosion and Damage (CODAM).

3.5.2 Requirements relating to reports of concern and the PSA's follow-up

In accordance with Section 2 A-3 of the Working Environment Act, companies in the petroleum industry are required to develop written procedures for internal notification in collaboration with employees and representatives. The PSA must carry out supervision to ensure that companies have in place satisfactory procedures and systems for internal notification.

27) *Regulations relating to health, safety and the environment in the petroleum activities and at certain onshore facilities* (Framework Regulations) Section 7.
28) *Regulations relating to management and the duty to provide information in the petroleum activities and at certain onshore facilities* (Management Regulations) Section 20.

Section 2 A-1 of the Working Environment Act governs the right of employees to report concerning conditions. The provisions must contribute to strengthening the actual freedom of expression in an employment situation. The provisions of the Working Environment Act include instances in which an employee gives notification of censurable conditions in the workplace that the employee has become aware of through their employment and that are or could be in breach of laws and regulations, industry guidelines or a general understanding of what is prudent and ethically acceptable. In such instances, the PSA's responsibility is to carry out supervision to ensure that companies have procedures for notification as described in Section 2 A-3 of the Working Environment Act.

The PSA does not have the authority to issue orders when it comes to Section 2 A-1 of the Working Environment Act, concerning the employee's right to notify, or Section 2 A-2, concerning protection against retaliation in connection with notification. These are matters of private law and are handled by the justice system.

The PSA must process all reports of concern in accordance with Section 2 A-4 of the Working Environment Act, which states that any individual who carries out work or services for the receiving body is obliged to prevent others from gaining knowledge of the employee's name or other identifying information.

3.6 Requirements for companies' health, safety and environment work

The operator has a special responsibility on behalf of the licensee to ensure that activities are conducted in a prudent manner and in accordance with the applicable regulations; see sections 1-6 and 10-6 of the Petroleum Act. The operator must ensure that all who carry out work for them comply with the requirements stated in the HSE regulations; see Section 10-6 of the Petroleum Act and Section 7 of the Framework Regulations. The operator also has a special obligation to follow-up with regard to compliance with HSE regulations, called "see-to-it" duty; see Section 7 of the Framework Regulations regarding responsibilities and Section 10-6 of the Petroleum Act regarding the special follow-up obligations of licensees and operators. See-to-it duty means the duty to, through the establishment of management systems and supervision, follow up to ensure that participants in petroleum activities comply with the requirements stated in or pursuant to the law. The responsibility of ensuring that the regulations are upheld will thus be a general and overarching duty to follow up on the completion of activities. Section 12 of the Framework Regulations also sets requirements for the operator's organisation and competence.

Licensees must, in addition to fulfilling their own obligations, facilitate the operator's work with the licensed activities and ensure that the operator fulfils their obligations; see Section 10-6 of the Petroleum Act and Section 7 of the Framework Regulations. The licensee must be able to document sufficient resources and competence to be capable of making decisions regarding the operator's management of HSE. The see-to-it duty requires the licensee to follow up on the operator in a systematic manner. How the see-to-it duty is being upheld must be recorded in the management system. Furthermore, licensees have a duty to take action if they discover conditions that are not in accordance with the regulations. Licensees have an independent obligation to obtain sufficient information and must take a risk-based approach in their fulfilment of the see-to-it duty. This means that, based on circumstances in specific cases, a licensee may be obliged to carry out an audit of the operator.

3.7 Requirements for management and follow-up

In accordance with Section 4 of the Regulations on Financial Management in Central Government, companies must set goals and performance requirements within the framework of available resources and requirements set by overarching authorities, and they must ensure that these goals and performance requirements are met, that the use of resources is efficient and that the company is operated in accordance with applicable laws and regulations. The company is responsible for obtaining sufficient management information and a sound decision-making basis.

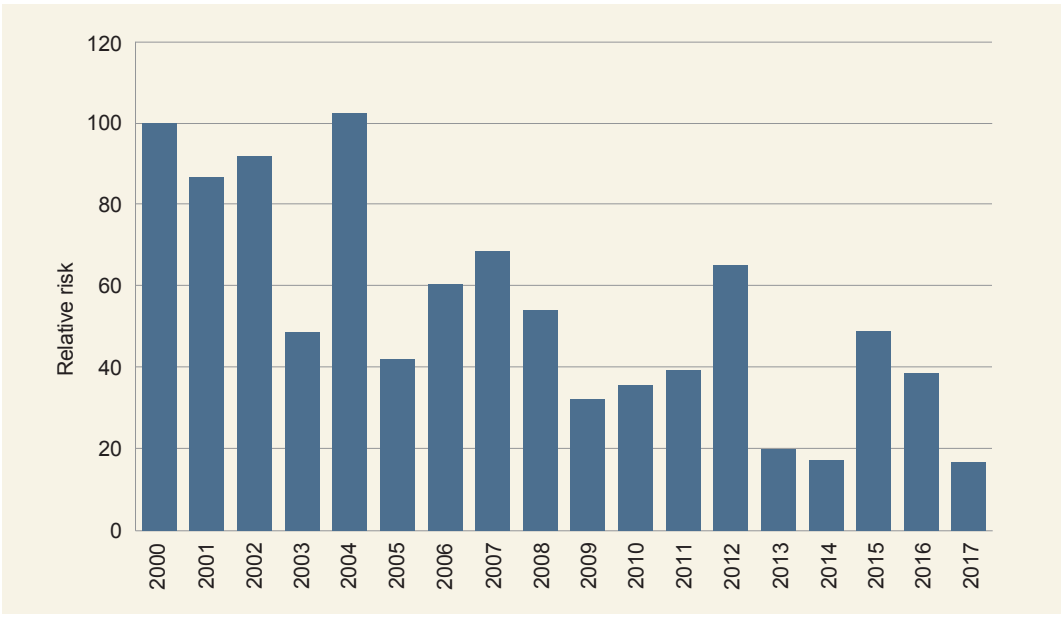
In accordance with Section 7 of the *Regulations on Financial Management in Central Government*, the responsible ministries must set overarching goals, management parameters and reporting requirements for subordinate agencies. Management, follow-up and control must be adapted to the company's individual characteristics, risks and significance; see Section 4. The companies must report on the achievement of goals and results internally and to the overarching authority; see Section 9.

4 The state of health, safety and environment on the Norwegian continental shelf

In order to monitor the risk status of the petroleum industry, industry players joined forces with the research community to develop Trends in risk level in the petroleum activity (RNNP) in 1999/2000. RNNP shows that there have been positive developments in the state of HSE in several areas since 2000, but in recent years there have also been serious incidents and other safety-related challenges that have given the PSA cause for concern.[29]

A total indicator for major accidents is part of RNNP. This indicator is based on serious incidents and the beginnings of incidents with major accident potential, such as fatalities, blowouts, explosions or similar. The indicator takes into account the severity of the damage or potential for damage, meaning more serious incidents have a greater impact on the indicator. Furthermore, the indicator takes into account the activity level in the industry, represented in terms of working hours per year.

Figure 1 Total indicator for the risk of major accidents on the Norwegian continental shelf in the period 2000–2017*

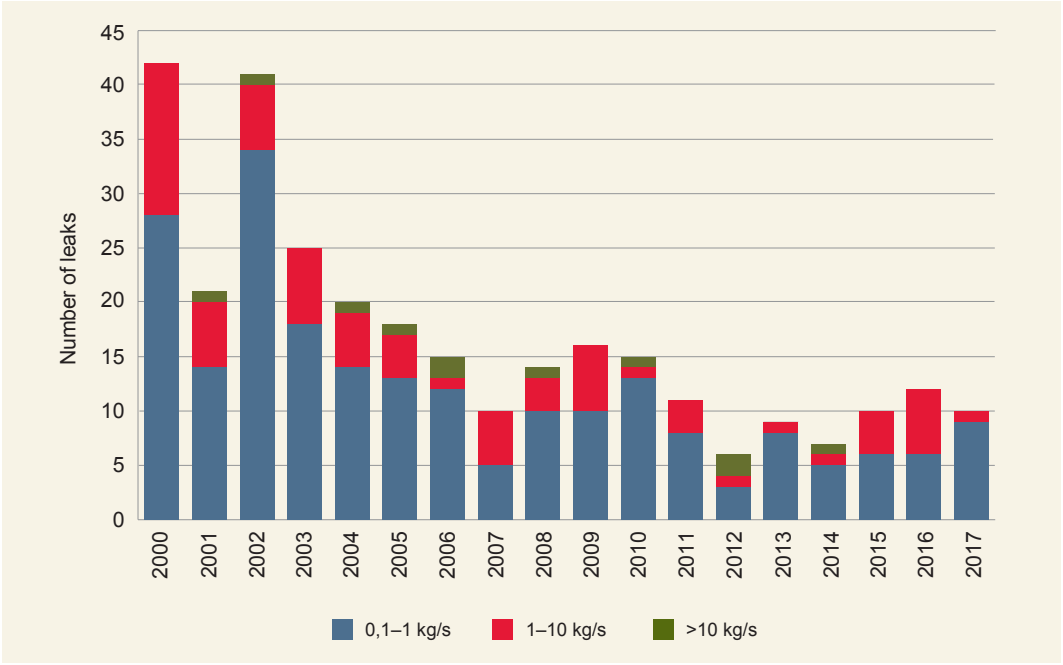


* The reference value for the total indicator is 100 in the year 2000.
Source: Petroleum Safety Authority

Figure 1 shows that the major accident indicator varies from year to year, but the underlying trend is that the risk level has declined in the period 2000–2017. The increase in the risk indicator in 2015 and 2016 is largely due to serious single incidents, including the fatal accident on the drilling rig COSL Innovator in 2015 and the well control incident at Songa Endurance on the Troll gas field in autumn 2016.[30]

29) Petroleum Safety Authority (2018) Annual Report 2017.
30) Petroleum Safety Authority (2017) *Sammendragsrapport — Risikonivå i norsk petroleumsvirksomhet 2016* (Norwegian only).

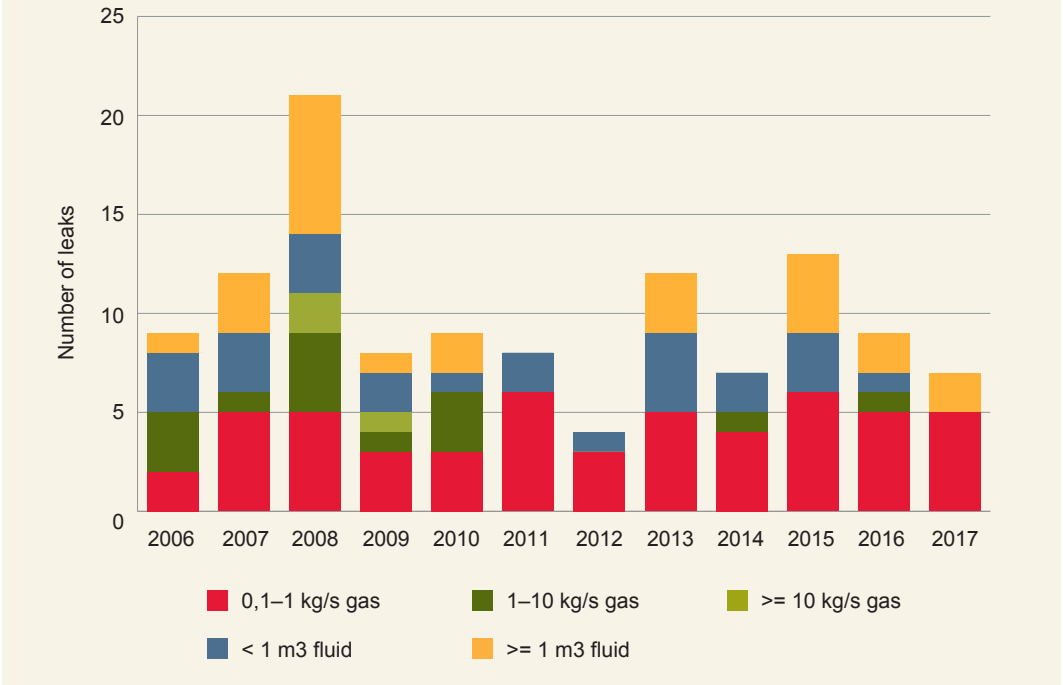
Figure 2 Number of hydrocarbon leaks in the Norwegian petroleum industry, all facilities, standardised against working hours, 2000–2017 [31]



Source: Petroleum Safety Authority

Hydrocarbon leaks are a significant risk factor in the Norwegian petroleum industry; see Report to the Storting 12 (2017–2018). Figure 2 shows that there was a significant decline in the number of leaks relative to the activity level (number of working hours) from facilities on the Norwegian continental shelf in the period 2000–2017. After 2014 there was an increase, but compared with the level in the early 2000s this is minor.

Figure 3 Overview of all unignited leaks (DFU1) at onshore production facilities, 2006–2017



Source: Petroleum Safety Authority

31) All leaks of over 0.1 kg/s are reported in RNNP.

For the onshore processing facilities, the development has not been equally positive. Figure 3 shows that the number of incidents varies between 7 and 13 in the period 2013–2017. There is no clear trend in developments in recent years.

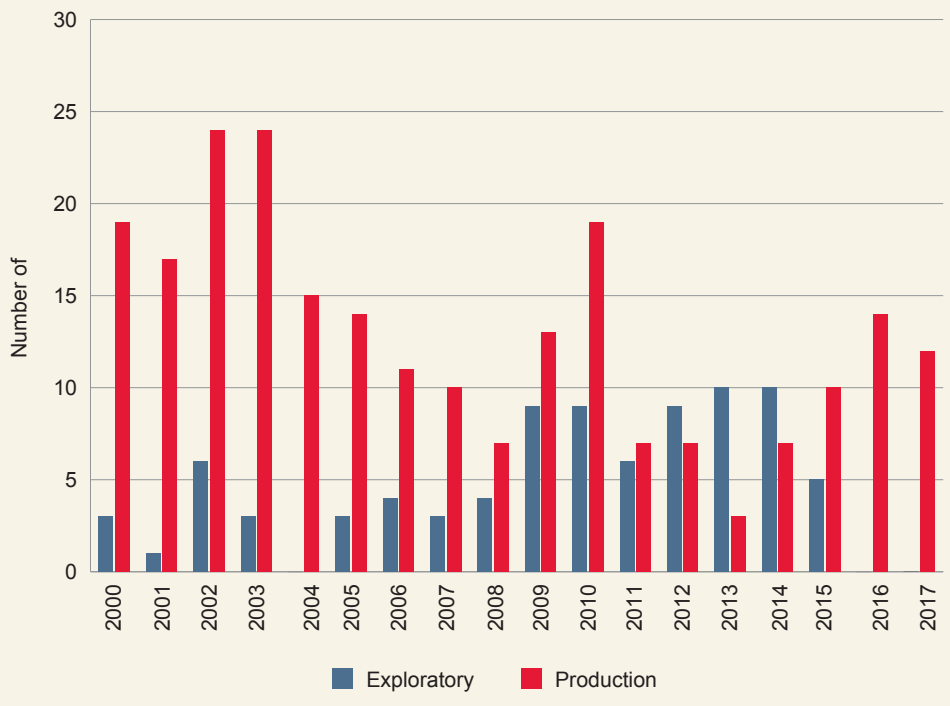
Well control incidents present a major accident risk because such incidents can cause blowouts and risk to health, safety and environment.[32] This was especially true after the Deepwater Horizon incident in the Gulf of Mexico in 2010; see Fact box 1.

Fact box 1 The Deepwater Horizon incident in the Gulf of Mexico

On 20 April 2010, a blowout, explosions and fire occurred on board the mobile offshore unit Deepwater Horizon in the Macodono Prospect oil field in the Gulf of Mexico. Eleven people were killed, several were severely injured, and the unit sank after two days. Over 4 million barrels of oil flowed freely out of the well before the leak was stopped 87 days later.
The accident caused the largest unforeseen oil spill in the history of the oil industry. As of 15 January 2018, the incident had cost the oil company BP, which was the operator of the field, 65 billion USD, which is more than 500 billion NOK. At that time, the company still had outstanding claims that had not been settled legally.

Sources: Petroleum Safety Authority, Wikipedia and Reuters (2018) BP Deepwater Horizon costs balloon to $65 billion

Figure 4 Number of well control incidents in exploratory and production drilling, 2000–2017



Source: Petroleum Safety Authority

Figure 4 shows that the number of incidents in connection with production drilling has increased, while no incidents occurred in connection with exploratory drilling in 2016 or 2017. The figure does not take into account the inherent accident potential, which varies significantly from one incident to another. In the same period, the exploratory activity was lower than before the drop in oil prices in 2014. In 2017 there were 34

32) Petroleum Safety Authority (2018) *Sammendragsrapport — Risikonivå i norsk petroleumsvirksomhet 2017* (Norwegian only).

exploratory wells and 173 production wells drilled and terminated on the Norwegian continental shelf.

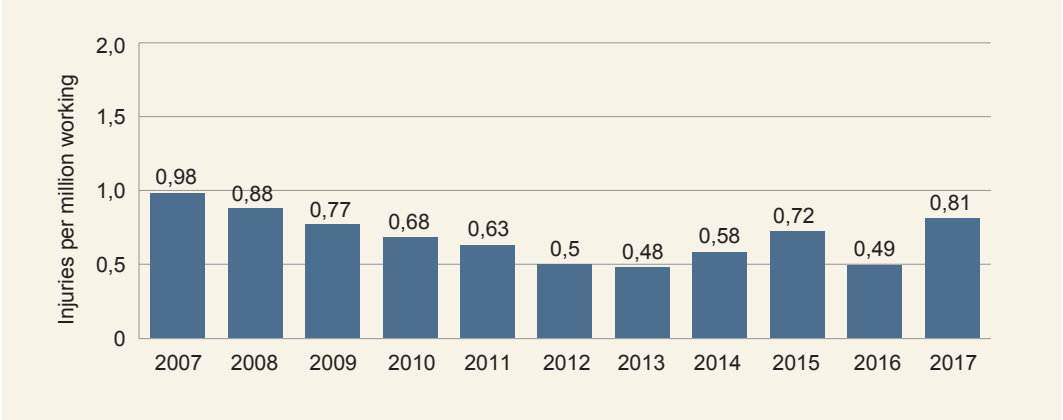
Incidents occur in 5–10 per cent of all production drilling operations. Well incidents are classified in three levels: 3 – low severity, 2 – medium severity, and 1 – high severity. In 2017 all 12 reported well control incidents were classified at level 3 – low severity.[33] Well control incidents at level 1 – high severity rarely occur. Since 2000 there have been four such incidents:

- 2004 – Snorre A
- 2006 – Krabbe
- 2010 – Gullfaks C
- 2016 – Songa Endurance

According to Report to the Storting 12 (2017–2018), the working environment standard has shown a mainly positive development in the period 2011–2017. Working conditions are surveyed regularly through questionnaires given to workers in the petroleum industry. The most recent questionnaire-based survey, which was conducted in 2017, showed a significant negative change in comparison with previous years. More workers than before claimed that inadequate maintenance results in worse safety conditions, and that production concerns take precedence over HSE.[34]

Fatalities and personal injuries are used as an indicator of the risk level of the industry and are included in the annual report from Trends in risk level in the petroleum activity (RNNP). In the past ten years there have been several fatal accidents. Most recently, in 2017 there was a very serious incident with a fatal accident on the rig Maersk Interceptor. There was also a major fatal accident with a helicopter in 2016 and a fatal accident on the rig COSL Innovator in 2015.

Figure 5 Number of serious personal injuries per million working hours — Norwegian continental shelf



Source: Petroleum Safety Authority

Figure 5 shows that the number of serious personal injuries per million hours has increased since 2013, with the exception of 2016. There were 205 serious personal injuries reported on the Norwegian continental shelf in 2017, versus 189 in 2016. Of the personal injuries reported in 2017, 27 are classified as serious. In 2016, 17 personal injuries were classified as serious.

33) Petroleum Safety Authority (2018) *Sammendragsrapport — Risikonivå i norsk petroleumsvirksomhet 2017* (Norwegian only)
34) Petroleum Safety Authority (2018) *Sammendragsrapport — Risikonivå i norsk petroleumsvirksomhet 2017* (Norwegian only)

5 The PSA's supervisory practices and authority

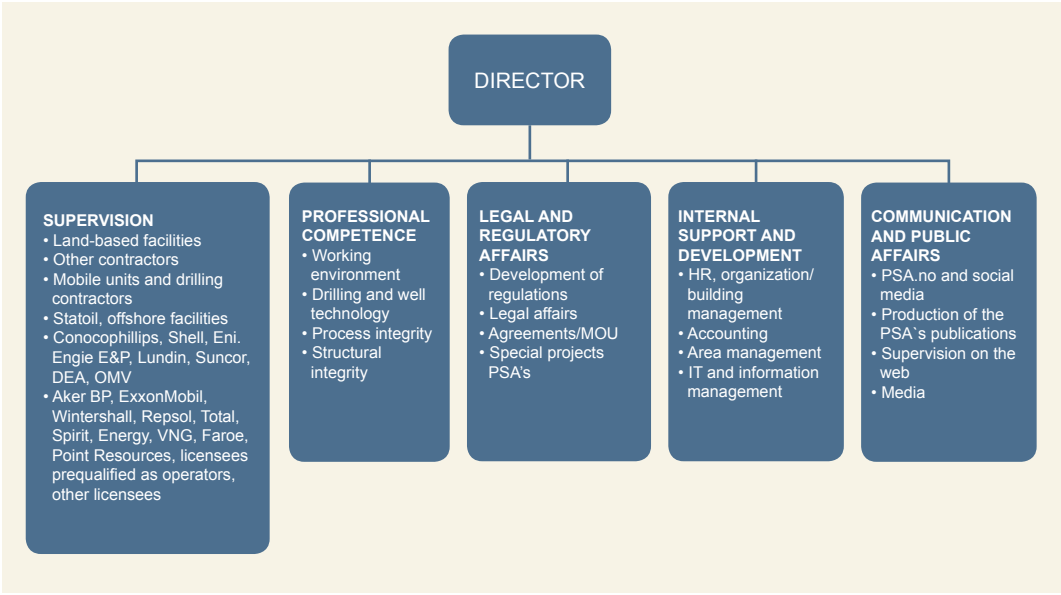
At the end of 2017, the PSA was responsible for the supervision of:[35]

- 85 fields in production
- 65 rigs/facilities with AoC
- approximately 300 subsea installations
- 8 onshore production facilities

5.1 Organisation, competence and resources for supervision

At the end of 2017, the PSA had 175 employees (169 FTEs).[36]

Figure 6 The PSA's organisation chart



Source: Petroleum Safety Authority

The PSA's organisation is divided into five areas: supervision, professional competence, legal and regulatory affairs, internal support and development, and communication and public affairs; see Figure 6.

The PSA notes in an interview that the areas of supervision and professional competence are organised in teams that share the responsibility for supervision of companies. The supervision teams are staffed from the six professional areas in the professional competence department. The professional competence department is also responsible for competence development and follow-up at the industry level. Each individual team is led by a supervision leader with product responsibility and formal decision-making authority.

35) *Role and area of responsibility.* <http://www.ptil.no/map-of-our-area-of-responsibility/category994.html> [15 August 2018].
36) Petroleum Safety Authority (2018) Annual Report 2017.

The PSA has internal guidelines for ethics and competence.[37] The Ministry of Labour and Social Affairs also states requirements for this in the letter of commitment and in instructions for the authority.[38] In accordance with the guidelines, new employees may not make a decision or assist in making a decision on any case involving a former employer for a period of two years after being hired. Employees are also prohibited from owning shares in companies for which they conduct supervision. There has been an investigation into whether these competence requirements are upheld; see Appendix 6. No employees hired after 1 January 2011 have carried out supervision of former employers within the quarantine period of two years. None of the employees involved in supervision activities own shares in companies for which they carry out supervision.

The PSA's operating budget for 2018 was approximately 297 MNOK. The annual report for 2017 states that the use of resources is distributed across four areas:

1. refundable tasks, which are primarily tasks financed through penalties and sector fees (56%)
2. internal administration (21%)
3. other externally directed activities (17%)
4. competence and professional development (6%)

Of the operating budget, 59 per cent (175 MNOK) is covered by fees and taxes paid by the industry.[39] The magnitude of fee- and sector-financed activities is determined through the consideration of Prop. 1 S in the Storting and the subsequent annual letter of commitment to the PSA. The determination of taxes and fees is also subject to regulations from the Ministry of Labour and Social Affairs.[40]

Table 1 The PSA's revenue from penalties and sector fees in (May) 2018 — NOK, in 1,000 NOK, 2013–2018

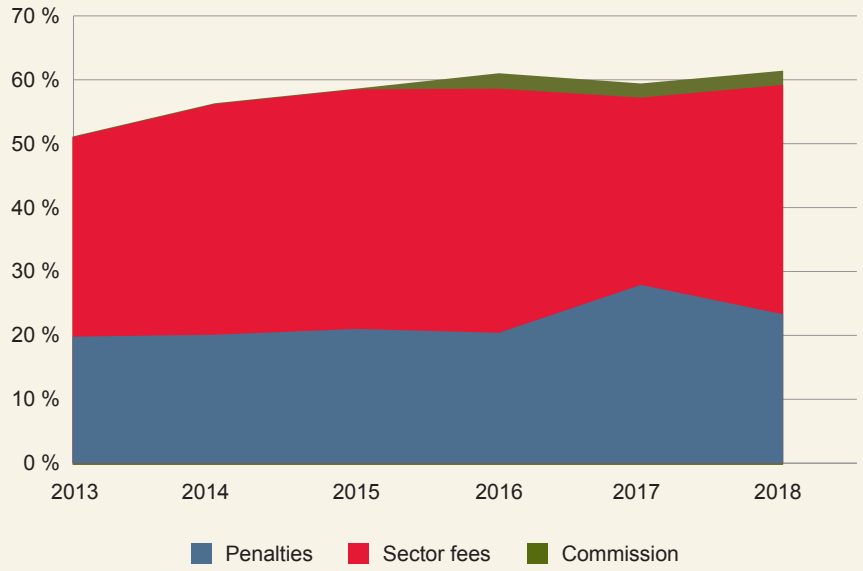
Revenue requirements	2013	2014	2015	2016	2017	2018
Supervision penalties	52664	53393	53997	53629	82745	69165
Sector fees	83182	95655	96174	100537	86894	106640
Total income	135846	149048	150171	154166	169639	175805
Change in %		**8,9 %**	**0,7 %**	**2,6 %**	**9,1 %**	**3,5 %**

Source: Ministry of Labour and Social Affairs, Letters of commitment — Petroleum Safety Authority, 2014–2018

Table 1 shows the amount the authority will collect from activities financed through penalties and fees each year in the period 2013–2018.

37) Petroleum Safety Authority (2017) *Habilitet i Petroleumstilsynet* (Norwegian only). Internal guidelines with appendix, last updated 27 April 2017. Appendix 2.
38) Ministry of Labour and Social Affairs (2017) *Letter of commitment 2017 — Petroleum Safety Authority,* 6 January 2017; Ministry of Labour and Social Affairs (2018) *Instruks om virksomhets- og økonomistyring for Petroleumstilsynet* (Norwegian only), 24 May 2018.
39) Prop. 1 S (2017–2018) *Ministry of Labour and Social Affairs*, chapter 642 onwards.
40) *Ordinance concerning the right to impose fees and sectoral fee for supervision and other follow-up of safety and environment within petroleum activities, 8 January 2013.*

Figure 7 Percentage of the PSA's operating expenses covered by revenue from penalties, sector fees and commission



Source: Ministry of Labour and Social Affairs, Letters of commitment — Petroleum Safety Authority, 2014–2018

In the period 2013–2018, the percentage of the PSA's operating expenses covered by penalties, sector fees and commission increased from 50 to 62 per cent; see Figure 7. This figure also includes commissioned activities (e.g. for Oil for Development). The figure shows that the penalty-financed portion of the operating expenses remains stable at around 20 per cent in the period 2013–2016. The revenue from penalty supervision increased significantly in 2017, and to a somewhat lesser degree in 2018. The Ministry of Labour and Social Affairs notes that there were annual changes in the penalty-financed operating expenses in the period 2013–2016 as a result of adjustments to the revised National Budget and rearrangement of the Fiscal Budget, but that this is not reflected in the figure. One reason for this is the need for adjustments to supervisory activities as a result of changes in the industry's activity level. The portion of the operating expenses financed by sector taxes increased throughout the period, with the exception of 2017.

5.2 The PSA's supervisory methods

Supervision, as defined by the PSA, refers to all contact between the authority and the subjects of its supervision, and all activities that provide the authority with a basis on which to evaluate whether the companies are taking the proper responsibility for operation. The authority follows the petroleum industry, meaning the licensees, through the entire life cycle, from application for an extraction licence through exploratory drilling, construction and operations, to termination and removal. Meetings, gathering of information, seminars, involvement in prequalification, issuing extraction licences, considering plans for construction and operations, applications for consent, investigations and so forth are all activities included in the definition of supervision.

According to the PSA, supervisory activities are divided into two main categories:

- Activities financed by penalties: audits and verifications resulting in audit reports that are published on the authority's website.

- Activities financed by sector fees: will cover actual costs for follow-up of the industry beyond what is covered by penalties.

The supervisory activities financed by penalties are audits and verifications. Audits are planned, systematic investigations into parts of a company's management system. The method for doing this is a review of documents and interviews with select people in the company. Verifications are spot checks to investigate whether management systems are functioning in practice. All activity (pre-audit work, execution, post-audit work, travel) carried out in connection with audits, verifications and investigations is covered by penalties. Also covered is the processing of applications for consent, plans for construction and operation, plans for facilities and operation, cessation plans, acknowledgements of compliance and evaluation of participants. Follow-up of incidents and reports of concern is also part of the supervision financed by penalties.

The PSA collects a sector fee for expenses incurred in connection with other follow-up tasks in the petroleum industry.[41] The fee is collected annually for the execution of the following tasks:[42]

- establishment of a comprehensive view of potential risks
- preparation and facilitation of supervision campaigns
- knowledge development in connection with safety-related challenges
- acquiring knowledge from accidents and incidents beyond the authority's jurisdiction
- transfer of experience and guidance
- 24-hour emergency preparedness
- administration, including management, accounting and other services as applicable to the above tasks

An overview of which sector tasks are prioritised each year is published on the authority's website.[43] The sector fee is collected annually from the companies according to a distribution key. The fee is based on the authority's calculation of the individual's portion of the total activity level. For example, Equinor's portion of the total activity level on the Norwegian continental shelf was calculated at 71.7 per cent in 2017.

5.2.1 Planning and prioritisation of supervisory activities

The PSA's supervision of companies in the petroleum industry will be risk-based. Risk-based supervision means that, when planning, the authority prioritises supervision of the areas in which the risk level is highest.[44] The PSA has internal guidelines for work with risk analysis that facilitates the authority's prioritisation of its efforts. The document is based on the principles of ISO 31000 Risk management, and defines risk-based supervision as follows:

> RRisk-based supervision is supervision directed primarily at the entities in which the HSE conditions are the worst, in which the risk of undesirable incidents or conditions is high, where the desire to act on existing problems is the lowest and/or where the efforts of the PSA will have the greatest effect for improving HSE in the industry. […] Risk analyses will focus on significant safety-related issues, but this alone will not determine the prioritisation. Other important considerations are the expected delivery to the Ministry and the agency's capacity (available framework: number of people and budget).[45]

41) *Ordinance concerning the right to impose fees and sectoral fee for supervision and other follow-up of safety and environment within petroleum activities* Section 4.
42) *Ordinance concerning the right to impose fees and sectoral fee for supervision and other follow-up of safety and environment within petroleum activities* Section 4.
43) *Oversikt over sektoroppgaver 2018* (Norwegian only). <http://www.ptil.no/getfile.php/1348195/Tilsyn%20p%C3%A5%20nettet/ Sektoroppgaver%202018%20rev%2001%20publiseres.pdf> [26 March 2018].
44) *What is supervision?* <http://www.ptil.no/about-supervision/category888.html> [16 August 2018].
45) Petroleum Safety Authority (2017) *Risikobasert tilsyn i hovedgruppene* (Norwegian only). Internal guidelines, last revised 2 May 2017.

When interviewed, the PSA noted that the following conditions are included in the basis for risk analysis work:

- experience from previous supervision, including experience with the industry, individual participants, activities or facilities
- risk level in the Norwegian petroleum industry (as stated in the RNNP report)
- annual meetings with the companies involved
- incidents and observed challenges involving facilities/platforms
- time since the previous supervision
- management instructions from the Ministry
- guidance from the authority's management

All projects and supervisory activities (results of risk analysis), regardless of the form of financing, are entered into a plan database. This database makes up the annual performance plan in which resources are allocated and tasks are staffed. The annual performance plan is also based on the letter of commitment from the Ministry of Labour and Social Affairs, reporting to the Ministry and guidance from the management. Prioritisations and resource allocation are reflected in an annual supervision strategy.[46] According to the PSA, the supervision strategy provides important guidance for planning. The strategy is based on the three main categories and goals of the letter of commitment:

- The risk of major accidents in the petroleum sector shall be reduced.
- The working environment in the petroleum industry shall be safe and serious.
- There shall be a high standard of knowledge regarding HSE as well as security in the petroleum industry.

In addition, the supervision strategy states what kinds of tasks should be prioritised.

5.2.2 The execution of supervision

The PSA has developed internal guidelines for the execution of supervision. The guidelines divide the execution into two phases:[47]

1. **Planning and facilitation of supervision**
   This includes the design and layout of the supervision, how the supervision will be staffed, the gathering of basic information and planning meetings. Before the supervision activities are initiated, staff prepare working documents (such as lists of topics, questions, verification plans, etc.) and presentation material for the initial meeting with the subject of the supervision.

2. **Conduction of supervision**
   In the execution phase of supervision, the subject of the supervision will first be sent a notification letter. The PSA holds a kick-off meeting with the company, and verifications and interviews are conducted according to the plan. The supervision of the company is finished with a concluding meeting at which the audit evidence is presented. After the audit report—with suggestions for any improvement points, nonconformities and any orders—has been quality-assured internally, it is sent to the subject of the supervision.

The PSA's supervision of licensees in the petroleum industry is system-oriented.[48] System-oriented supervision means that the supervision is directed towards the companies' management systems and is carried out through audits and verifications. It has come to light in interviews with the trade unions that they believe the PSA has an

46) Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.
47) Petroleum Safety Authority (2017) *Revisjonsprosedyr*e (Norwegian only), last updated 13 March 2017.
48) Ministry of Labour and Social Affairs (2017) *Health, safety and working environment conditions and trends in the Norwegian petroleum industry.*

unduly high level of trust in what it is presented by the companies. The authority too often assesses compliance based on system-based supervision rather than assessing real quality and the actual contents of plans and procedures. According to the trade unions, this trust-based model in which communication with the companies' management forms the basis, was formed at a time when investors' expectations and quarterly reporting were not given the same weight. According to the trade unions, it is not always the case that the situation described by company management is in alignment with the actual situation at a facility or platform.

Otherwise, the trade unions and companies interviewed stated that they mainly find the PSA to be a professional authority with good competence in HSE. Dialogue with the authority is good, and the authority lays the groundwork for the tripartite collaboration to function. Norwegian Oil and Gas finds the PSA to be a competent and professional supervisory body that does a good job of fulfilling its regulatory responsibility. Regarding improvement points, Norwegian Oil and Gas notes that the PSA should be more goal-oriented in its planning and base more of its supervision on information about risks, for example from the tool RNNP. Norwegian Oil and Gas feels there is some repeated supervision of topics or facilities with no particular nonconformities or unique risk factors. The trade unions also give the PSA a generally positive appraisal, but at the same time claim that the authority lacks capacity and competence in the areas of ICT, technical conditions and the design phase when facilities are being planned and constructed.

Advance notice of supervision

For instance, notification of the supervision of Equinor and Songa Offshore in autumn 2017 was issued nearly three months in advance.[49]

Norwegian Oil and Gas notes that it would like to receive a clearer supervision plan for offshore facilities, corresponding to the one that the companies receive for the onshore facilities. This would help to improve resource planning and the coordination of internal and external auditing. The PSA's audits are a key source of education and improvement of HSE, and the companies want to get as much as possible out of this activity.

One trade union commented that the PSA must provide advance notice of supervision of offshore facilities in order that helicopters and any necessary accommodation at the facility can be arranged. It is also often necessary for the PSA to have reviewed documentation prior to the supervision. The trade union therefore feels that in most instances it is sensible to give advance notice of supervision, for the benefit of both the company and the PSA. Nevertheless, certain trade unions claim that it can be easy for the companies to hold themselves to a lower standard of safety when the authority always notifies them of supervision far in advance. Several trade unions believe that the PSA should also talk to people they have not arranged to speak with in advance, without the presence of management. They find that the PSA's supervision is highly scripted when they have given plenty of advance notice. In general, the PSA feels that issuing advance notification of supervision has a positive effect. It is not the PSA's impression that the companies choose to maintain a lower standard of safety, as certain trade unions claim.

The PSA conducted two unannounced audits during the investigation period. The trade unions would have preferred that the PSA conduct more of these. When interviewed, the PSA notes that it conducted two unannounced audits of onshore facilities in

49) Petroleum Safety Authority (2017) *Varsel om tilsyn med planlegging og gjennomføring av bore- og brønnoperasjoner på Songa Endurance (oppgave nummer 001085020)* (Norwegian only). Letter to Statoil Petroleum AS, 26 June 2017. According to the letter, the supervision was planned to begin on 12 September 2017.

collaboration with the Labour Inspection Authority. The audits were concerned with salary and employment conditions and the results were reported to the operators of the facilities. In connection with the audit reports and identified nonconformities, it became necessary to clarify the scope of the Regulations on general application of wage agreement for construction sites in Norway. According to the PSA, a clarification from the Tariff Board resulted in the withdrawal of the audit reports, and these are therefore not public or included in the supervision database. The PSA also notes that supervision is carried out with very short deadlines.

Use of observers

The PSA encourages subjects of supervision to have observers present during audits, including during interviews. This is stated in the authority's internal auditing processes.[50] The observer is appointed by the company, acts as the company's representative and facilitates supervision on behalf of the company. The observer can help to clear up misunderstandings and witness the audit on behalf of the audited company. The observer will not have the right to speak in interviews unless it is necessary to clear up obvious misunderstandings. It is also stated that the observer must not have management responsibilities for the person being interviewed. According to the PSA, as part of all supervision of facilities and platforms there is a separate meeting with the safety representatives. This meeting is held without an observer present.

There are different views among the interviewed trade unions, employer organisations and companies as to whether the observer scheme is working well. Some of the trade unions believe that announced supervision with an observer will, in certain cases, give the authority an inaccurate image of the situation. Employees do not always dare to give their honest opinion when an observer, who was selected by the company's management, is present, according to the trade unions. Other trade unions, employer organisations and companies believe that this is necessary, and that there is a need for someone to coordinate the supervision from the company's side. Certain companies noted, for example, that there may be assertions or interpretations of the facts that are incorrect, and which must be clarified in the course of supervision. According to one of the companies, facts are experienced differently depending on one's position within the company.

Information on practices surrounding the use of observers was obtained from the County Governor of Rogaland and from the Norwegian Environment Agency. The County Governor of Rogaland, who conducts supervision of health and hygiene in companies, believes fundamentally that observers should not participate in the meetings that the authority conducts with employees, safety representatives and spokespeople. According to the County Governor of Rogaland, it is important for spokespeople and safety representatives to be able to speak freely with the supervisory authority, particularly in times of downsizing.

The Norwegian Environment Agency, which has supervisory responsibility for the natural environment within the petroleum industry, states when interviewed that it does not prevent companies from using observers during supervision. Safety representatives are always contacted and invited to initial meetings. The Norwegian Environment Agency strives to limit the number of participants from the companies, so that the informants do not influence one another. The Norwegian Environment Agency is strict on the policy that observers must remain passive in meetings with representatives from the company.

50) Petroleum Safety Authority (2017) *Veiledning til prosedyre for revisjoner i Petroleumstilsynet* (Norwegian only), last updated 1 July 2017.

5.2.3 Reporting of completed penalty supervision

After completing supervision (audits/verifications), the PSA prepares a report that is published on the authority's website to promote education and transfer of experience for the companies that they supervise. The report contains the results of the supervision in the form of audit findings. These are classified in three categories:

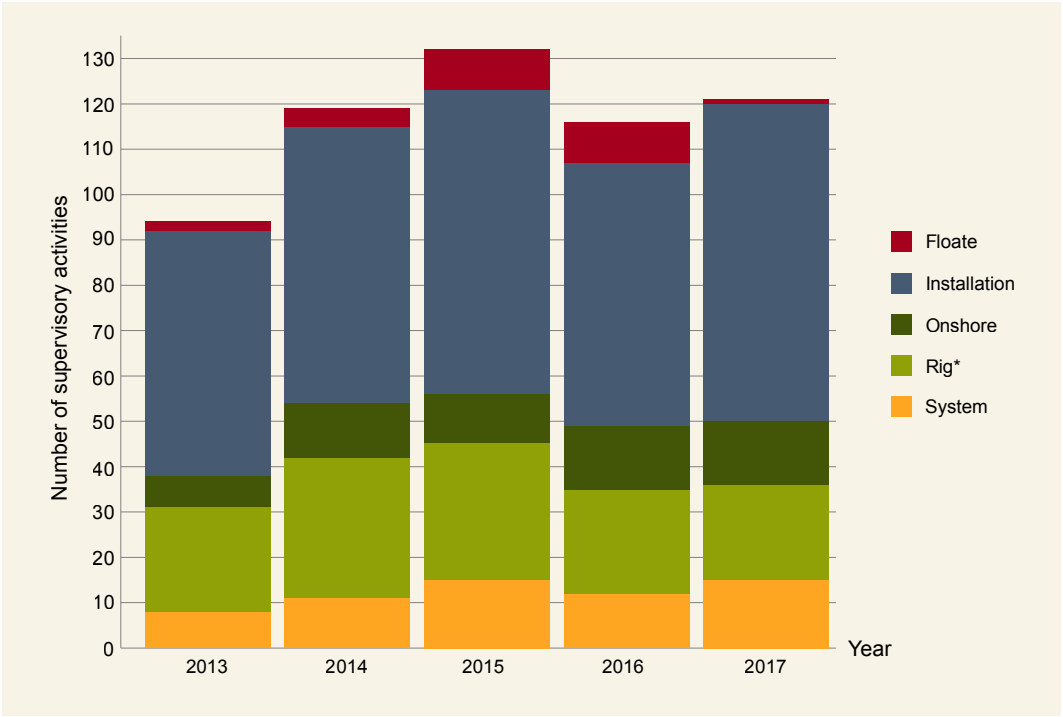
- nonconformity: associated with observations where the PSA believes it has identified a breach of the regulations.
- improvement point: associated with observations where the PSA finds shortcomings but does not have enough information to identify a breach of the regulations.
- other comments: opportunity to add comments concerning matters that the PSA wants to address but cannot be classified as nonconformities or improvement points.

Finally, the report is sent to the companies concerned, but is not published until at least a week after it has been sent. Factual errors pointed out by the companies prior to publication may result in the creation of a new version of the report.[51]

Organisation of and results from penalty-financed supervision carried out in the period 2013–2017

There were 582 penalty-financed supervisory activities carried out in the period 2013–2017.[52]

Figure 8 Distribution of supervisory activities across different types of installations/facilities in the period 2013–2017 (N=582)



* The term "rig" here refers to drilling rigs and well intervention units.
Source: Office of the Auditor General

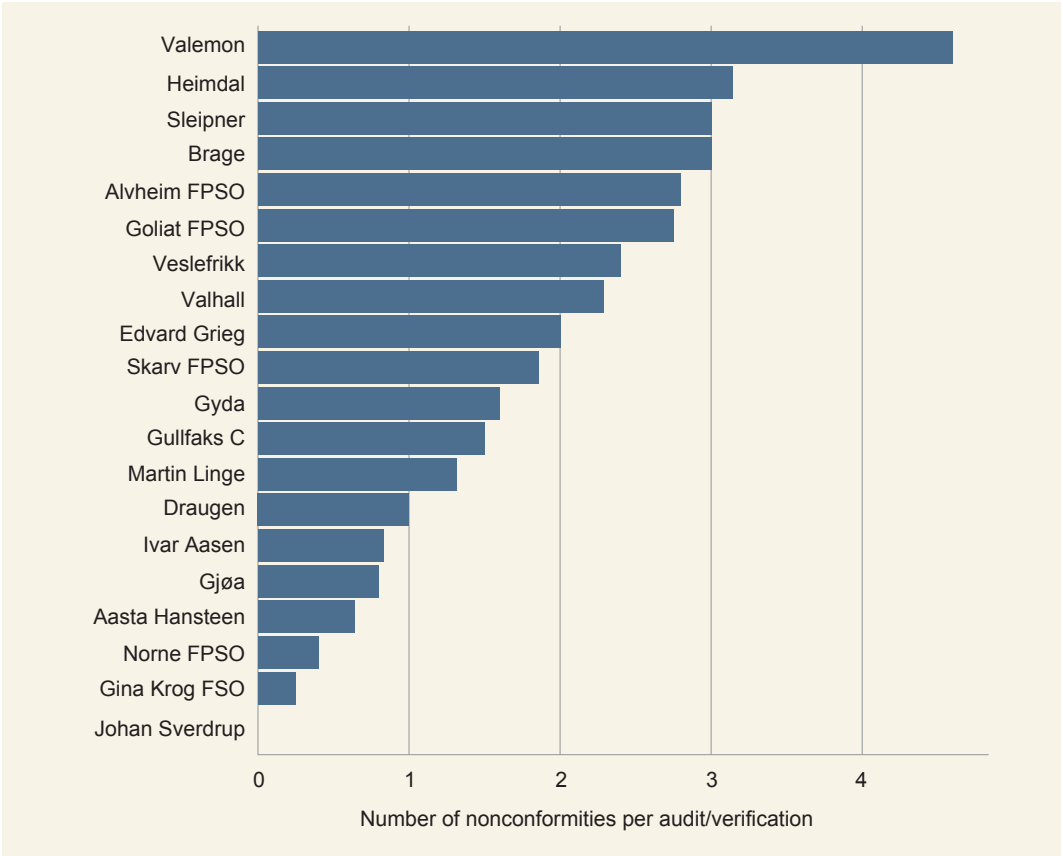
Figure 8 shows that the PSA carries out the largest proportion of supervision activities on onshore production facilities. The number of audits of rigs varies and has declined since 2015. The Ministry of Labour and Social Affairs notes that the number of rig days

51) Petroleum Safety Authority (2017) *Veiledning til prosedyre for revisjoner i Petroleumstilsynet* (Norwegian only), last updated 1 July 2017.
52) This is not an exhaustive count of the number of supervisory activities carried out by the PSA in this period. Supervisory activities that are not publicly available, or that were financed by sector fees, are not included in this figure.

varies and was rising until 2013. From 2015 to 2017 the number of rig days fell by about 40 per cent, from just under 10,000 in 2015 to less than 6,000 in 2017; see Report to the Storting 12 (2017–2018) Health, safety and environment in the petroleum industry, Figure 3.5. It is therefore natural that the number of audits of rigs decreased in the same period, according to the Ministry of Labour and Social Affairs. The number of audits of onshore facilities increased somewhat in this period. The same is true for supervision of the companies' management and follow-up systems, which are typically broad audits directed towards the company's headquarters or onshore organisation.

There were 310 audits of onshore production facilities conducted in the period 2013–2017. There is a large variation in the number of nonconformities per audit among the various onshore facilities.

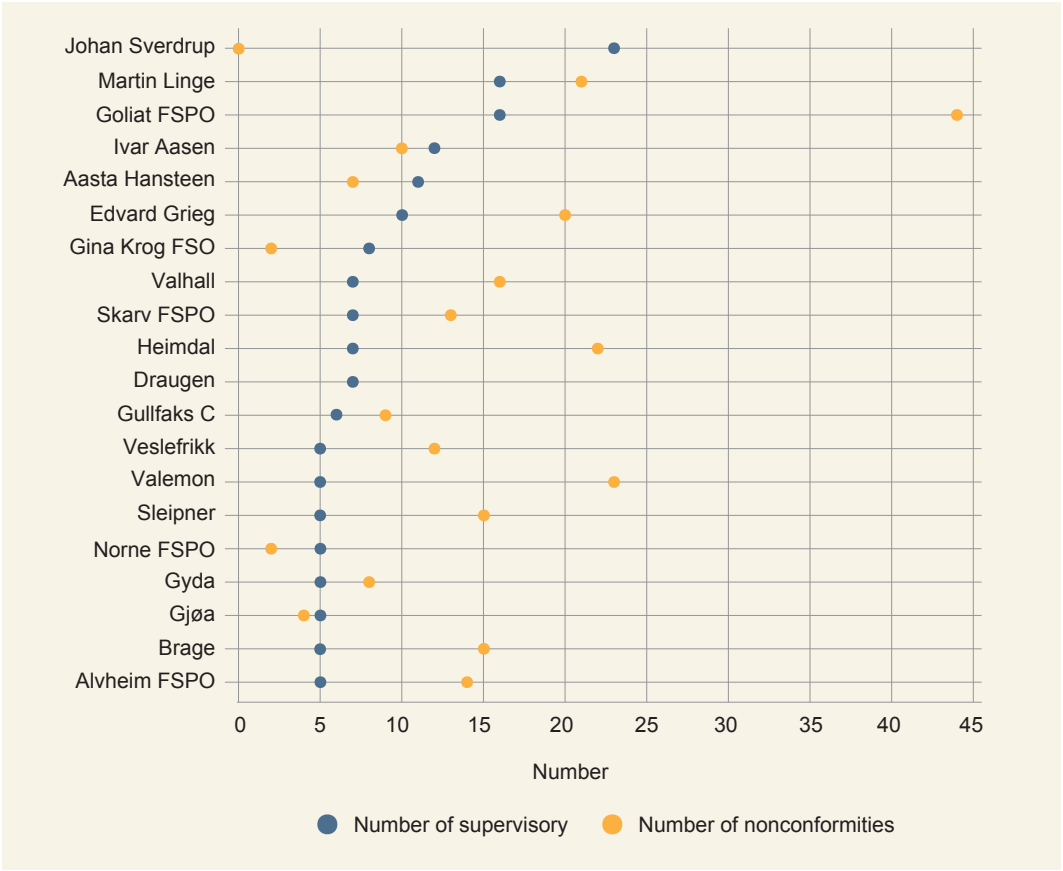
Figure 9 Average number of nonconformities per audit/verification per production facility in the period 2013–2017* (N=20)



* Only facilities with more than five audits/verifications in the given period are included in the figure. AoC supervision is not included.
Source: Office of the Auditor General

Figure 9 shows that the facility with the most nonconformities per supervisory activity is Valemon, with 4.6 nonconformities per audit/verification. The PSA carried out five supervisory activities concerning Valemon in the period in question. Other facilities with a relatively high average number of nonconformities per supervisory activity are Heimdal (3), Brage (3), Sleipner (3) and Alvheim FPSO (2.8). Goliat has an average of 2.8 nonconformities per supervisory activity and was subject to 16 supervisory activities in the period.

Figure 10 Number of supervisory activities and number of nonconformities per audit/verification at production facilities in the period 2013–2017* (N=20)



Source: Office of the Auditor General
*The facilities are ranked by the number of supervisory activities the PSA conducted with the company during the period.
Only companies with which the PSA has conducted at least five supervisory activities in the period are included. AoC supervision is not included.

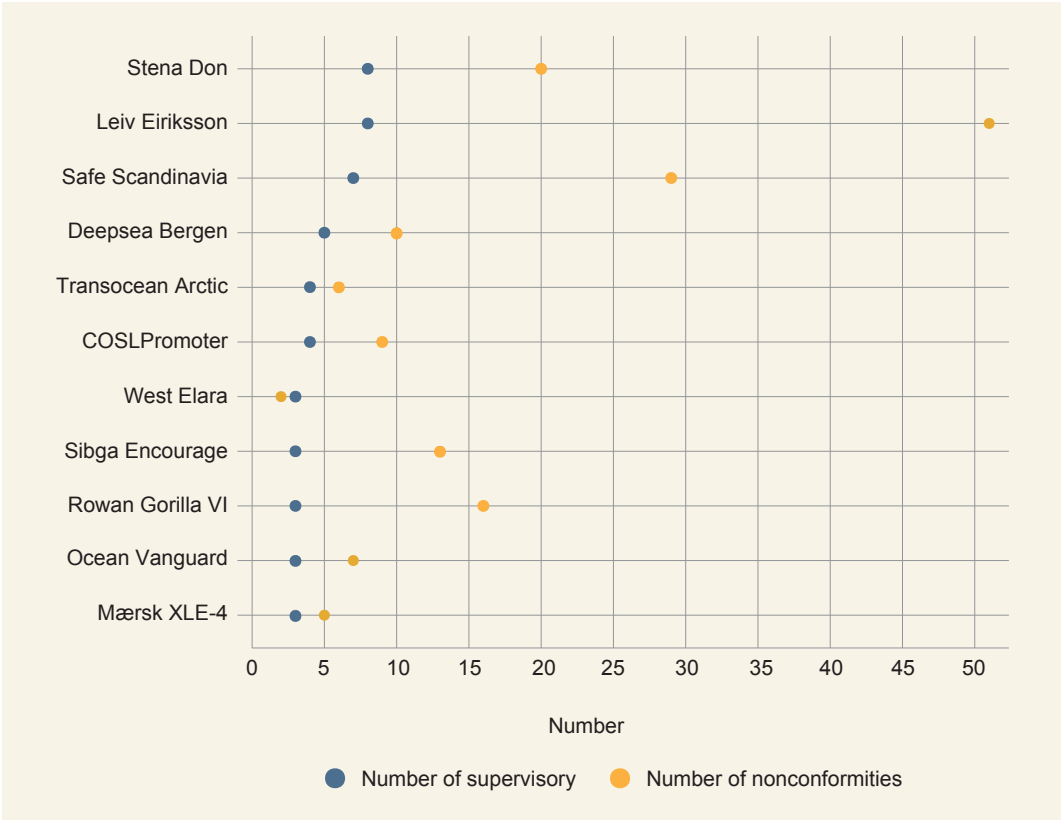
Figure 10 shows which facilities were subject to the most audits or verifications in the period 2013–2017. The PSA carried out the most audits and identified verifications (23) and the fewest nonconformities (0) in its supervision of the Johan Sverdrup project.

The PSA states in an interview that they seldom identify nonconformities in the project phase and especially not in the phases prior to processing the plan for development and operation, because most of the matters they supervise can be changed before the facility is put into operation. The findings of the supervisory activities are therefore treated by the authority as improvement points that can be remedied. In the supervision of Johan Sverdrup, there are on average 1.6 improvement points per supervisory activity.

Figure 10 shows that there is little correlation between how many supervisory activities the PSA carries out and how many nonconformities they find, with the exception of Goliat. It is nevertheless worth noting that several of the facilities that were subject to many supervisory activities were in an early phase (as a rule, the facilities are in the construction phase or entering the operation phase). Facilities with a very high number of nonconformities are Goliat, Heimdal and Valemon. These facilities have the most nonconformities per supervisory activity.

In the period 2013–2017, the PSA carried out 128 audits and verifications of rigs and floatels.

Figure 11 Number of nonconformities and number of audits/verifications of drilling rigs/floatels in the period 2013–2017

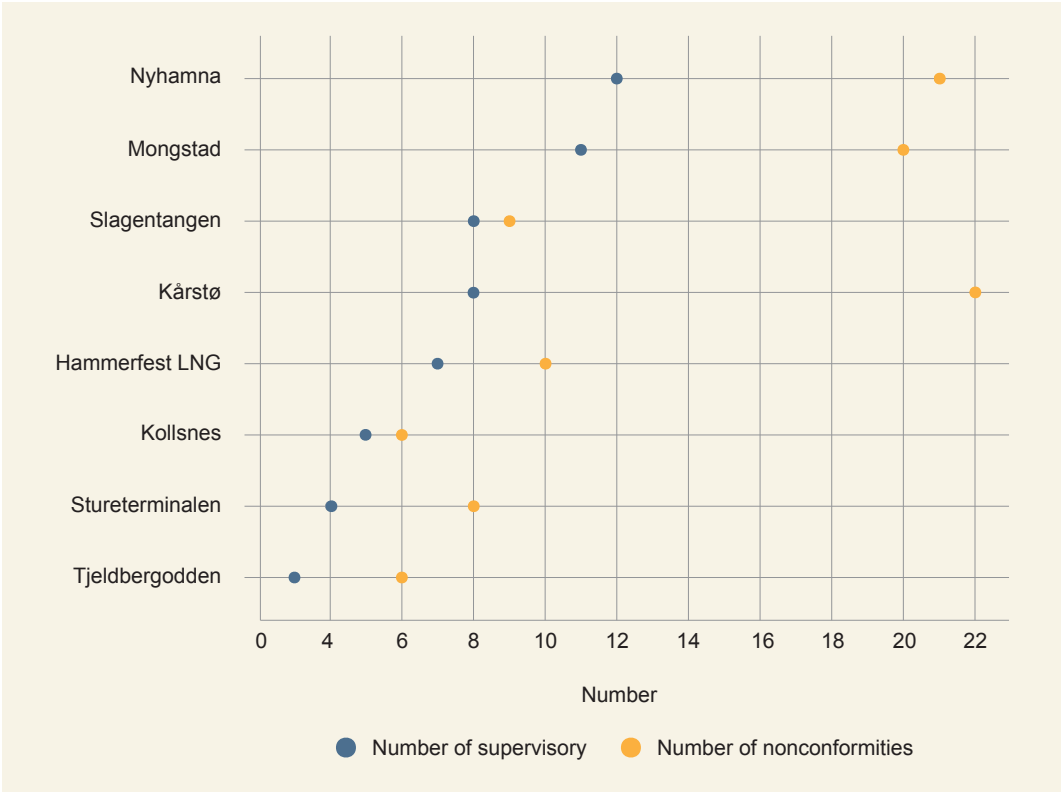


Source: Office of the Auditor General

Figure 11 shows the number of nonconformities and audits/verifications for the drilling rigs and floatels that were subject to three or more supervisory activities in the period 2013–2017. Audits and verifications conducted in connection with the processing of AoCs for mobile offshore units often result in a high number of nonconformities per supervisory activity and are carried out in individual areas based on maritime regulations. These are therefore not included in the figure.

The figure shows that the three rigs with the most nonconformities per audit/verification are Leiv Eiriksson, Safe Scandinavia and Stena Don. These are the three rigs for which the PSA has carried out the most supervision. Two of the rigs with a relatively high number of nonconformities, Songa Encourage and Rowan Gorilla VI, however, were only subject to three supervisory activities each. Songa Endurance is indeed not included in the figure because the PSA only carried out one supervisory activity for the facility.

Figure 12 Number of nonconformities and number of supervisory activities with onshore production facilities in the period 2013–2017



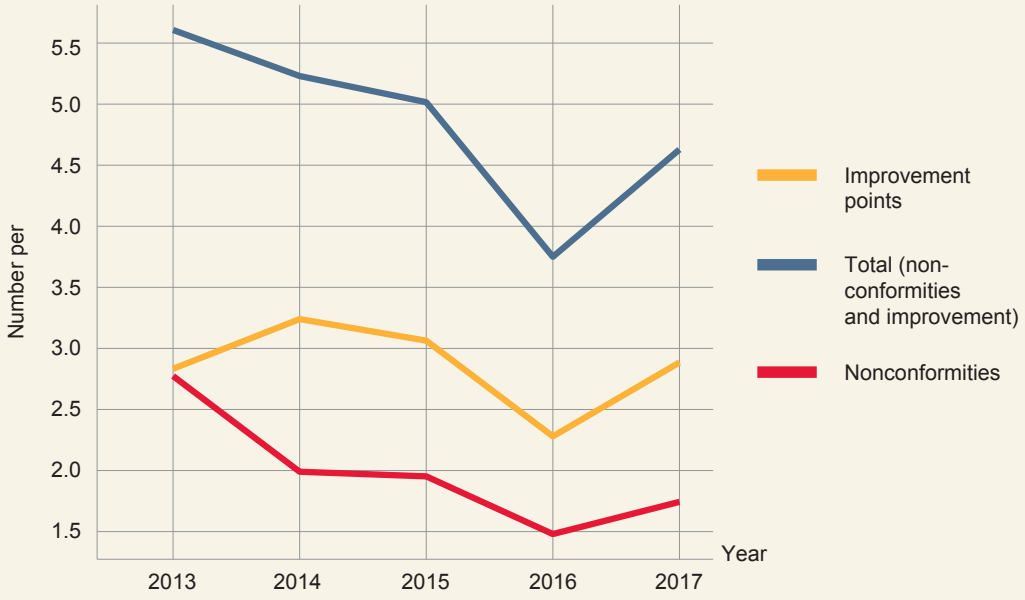
Source: Office of the Auditor General

There were 58 supervisions of onshore production facilities carried out in the period 2013–2017. Figure 12 shows that the onshore production facilities Kårstø, Nyhamna and Mongstad had the highest number of nonconformities per supervisory activity in the period 2013–2017. The figure also shows that the onshore production facilities with the fewest nonconformities were also subject to the fewest supervisory activities. The facility Kårstø, with a total of 22 nonconformities, and the facility Slagentangen, with a total of 9 nonconformities, were each subject to 8 supervisory activities.

The PSA's supervision of the petroleum industry must be risk-based. This means that the supervision is oriented towards entities or facilities where the HSE conditions are the most challenging and critical, and where the authority's efforts will be able to have the greatest effect.[53]

53) Ministry of Labour and Social Affairs (2017) *Health, safety and working environment conditions and trends in the Norwegian petroleum industry*.

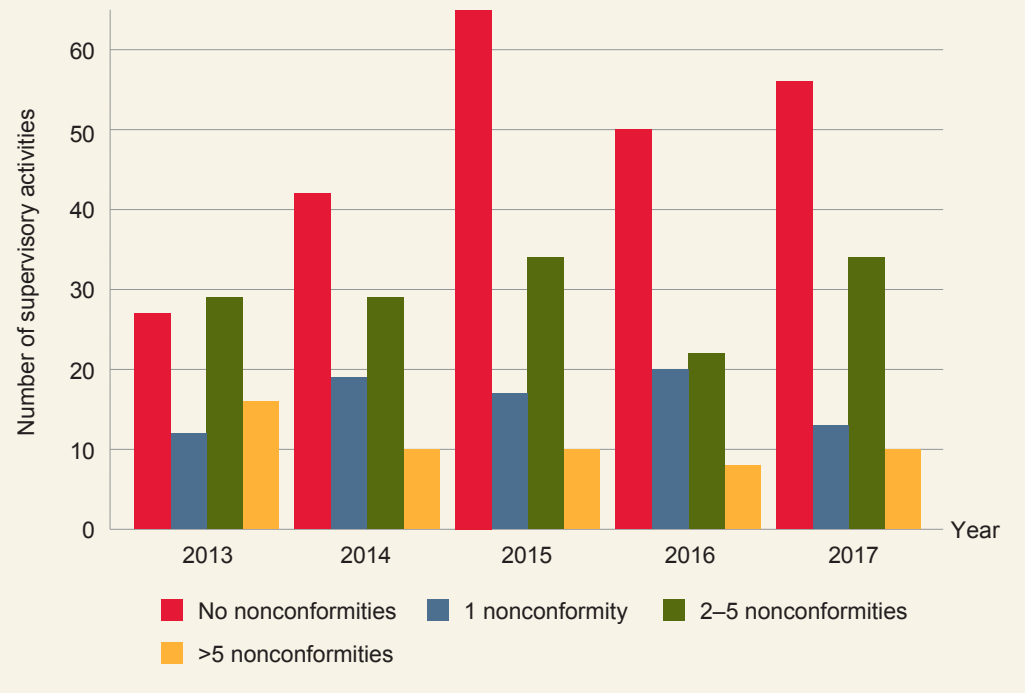
Figure 13 Average number of nonconformities and improvement points per audit/verification in the period 2013–2017* (N=582)



*Supervision related to applications for acknowledgement of compliance is excluded
Source: Office of the Auditor General

Figure 13 shows that the average number of nonconformities per audit/verification decreased in the period 2013–2017, from 2.8 nonconformities per supervisory activity in 2013 to fewer than 2 in 2017. The average number of improvement points is at the same level in 2017 as in 2013.

Figure 14 Number of supervisory activities with differing numbers of nonconformities, 2013–2017 (N=582)



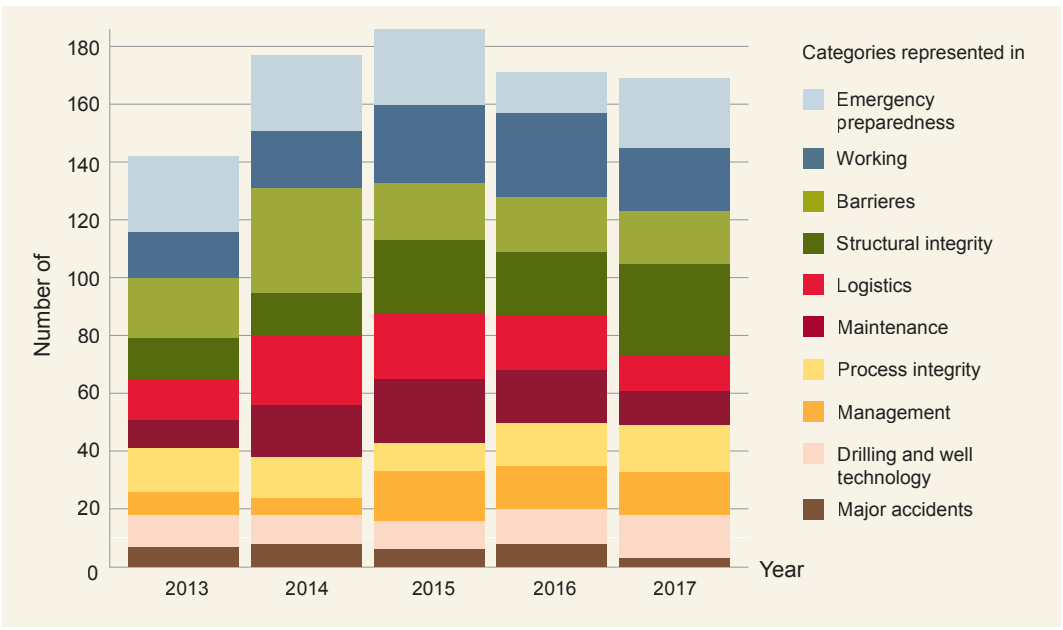
Source: Office of the Auditor General

Figure 14 shows that the number of supervisory activities in which no nonconformities were identified increased in the period 2013–2015, decreased somewhat in 2016 and increased again in 2017. The PSA notes that in the same period there was an increase in the number of supervisory activities directed towards the management and follow-up systems of companies, from 8 in 2013 to 15 in 2017. Supervisory activities of this type generally identify few nonconformities. Nevertheless, the authority believes these supervisory activities to be of great value.

The PSA carries out supervision within various categories. By categorising the PSA's supervision in the period 2013–2017 it is possible to create a picture of how many audits and verifications are conducted and how many nonconformities are identified across the different topics. The categorisation is based on topics as given for the individual supervisory activities, and one supervisory activity can have multiple topics; see Appendix 1, figures 19 and 20.

The topics of a supervisory activity can be overlapping; for instance, in many cases emergency preparedness and logistics will overlap.

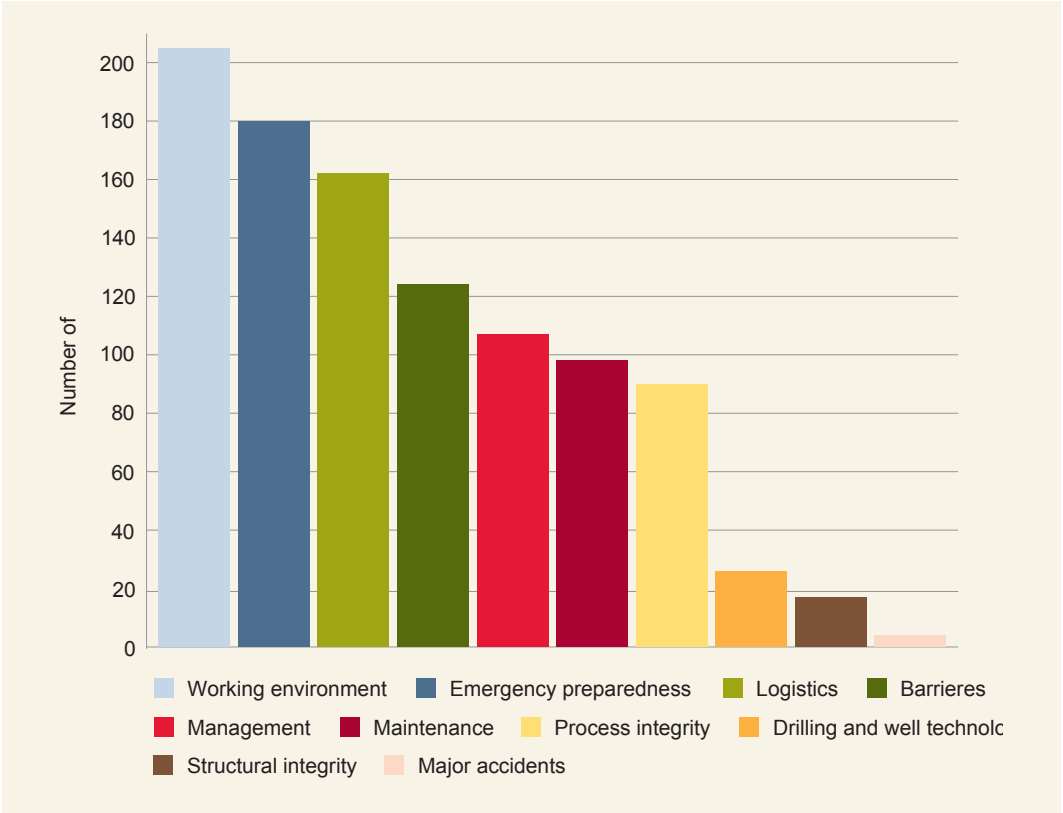
Figure 15 Number of audits/verifications carried out in the period 2013–2017 within different categories* (N=845)



* One supervisory activity can have several categories
Source: Office of the Auditor General

Figure 15 shows how the PSA's penalty supervision was divided across various teams in the period 2013–2017. The figure shows that the PSA carried out the most supervision in the topics of emergency preparedness, working environment and barriers, and less supervision in the topics of structural integrity, logistics, maintenance, process integrity, maintenance, drilling and well technology, and major accidents. One reason for there being less supervision in major accidents, drilling and well technology and management is that these are cross-sectional topics and are included in supervision of other topics. For a more detailed description how the nonconformities identified by the PSA are distributed across the various topics, see Appendix 1, figures 19 and 20. The figure also shows that over time there is less supervision in the categories of barriers, major accidents and logistics. The number of supervisory activities involving maintenance increased until 2015, while there was a decrease in supervisory activities concerning this area in the years 2016 and 2017.

Figure 16 Number of nonconformities within different categories in the period 2013–2017 (N=1013)*



* This includes all nonconformities from fee supervision in the period 2013–2017. Each nonconformity is categorised based on the regulations that the PSA refers to in its audit reports.
Source: Office of the Auditor General

Figure 16 shows that the number of nonconformities in different categories varies. The PSA identifies the most nonconformities in areas such as working environment, emergency preparedness and logistics. There are far fewer nonconformities in areas such as major accidents, structural integrity, and drilling and well technology. The supervision database shows that a relatively high number of supervisory activities are carried out in topics where the number of nonconformities is low, such as structural integrity.

The PSA noted in an interview that audits with many nonconformities can have good effects. In practice, however, follow-up activities that address prevention and systemsproduce equal or greater effects, according to the authority. The PSA also pointed out that there was wide variation in the number of nonconformities per supervisory activity in the period 2013–2017, but that this, in the authority's view, must be chalked up to coincidental variation. The authority also notes that it has been a goal to collect several findings as grounds for nonconformities at the management level, something that can also help to explain this variation.

The PSA stated in an interview that in their view, supervision in which no nonconformities are identified can also have very good effects. The PSA also states that categories with many nonconformities, such as maintenance, are categories for which the regulations are fairly detailed, and where it is easier to observe nonconformities during inspection and find a legal basis for those nonconformities. Supervision in the topic of structural integrity has few nonconformities per audit, but is often directed towards onshore organisation and/or engineering companies and is often carried out in connection with development projects where nonconformities are

seldom noted. The operators are often able to rectify matters before the facility enters into operation, and therefore the authority often only identifies improvement points, according to the PSA. The PSA also notes that it is normal for fewer nonconformities to be identified in audits where physical inspection is not carried out.

5.2.4 Follow-up of completed supervision

The individual supervision team is responsible for the follow-up of audits.[54] The PSA noted in an interview that it concludes supervision when it trusts that the company has identified, planned or implemented sufficient measures to rectify the nonconformities and improvement points identified in the audit report. As a rule, this is achieved by the company providing a written explanation of measures and plans for implementation. If needed, the authority can request documentation of measures that have been carried out, or confirm that the measures have been rectified by conducting a new audit or verification. The authority can then carry out a new supervisory activity for which the topic is the follow-up of previous nonconformities and improvement points, or it may be that the relevant topic is included in or is investigated in new supervision of the same company or facility. Follow-up of previous supervision is a separate point in the supervision strategy. However, it is not always stated in the audit reports whether follow-up is part of the basis for the supervision, as the reports first and foremost contain identified nonconformities and improvement points.

Several of the interviewees pointed out that the authority follows up to ensure that nonconformities are resolved, to a greater extent now than previously. This was confirmed by all the interviewed companies and several of the trade unions. The companies state that they are concerned with resolving nonconformities, and that this is taken very seriously. However, several parties feel that the PSA has too much trust that the companies actually are resolving the nonconformities. The case investigation of Goliat, for example, shows that the company notified the authority that nonconformities had been corrected. Afterwards, it transpired that a number of the nonconformities had not in fact been corrected. This illustrates some of the issues with follow-up based on written responses and trust that the companies are rectifying nonconformities.

Several trade unions remark that there are no consequences for the companies if they fail to rectify nonconformities or follow orders, and that the authority is not adept enough to ensure that the companies are following up the nonconformities identified through supervision. For instance, they believe that Equinor does not take findings seriously enough and does not have respect for the PSA and the orders they receive. One of the trade unions feels that in some instances the company challenges the PSA and argues against the nonconformities instead of resolving them. The representatives for one of the trade unions represented in this company noted that internal work orders created following supervision had been cancelled. They feel that in many cases it is not enough for the PSA to accept a letter describing plans and measures for the rectification of nonconformities. One of the trade unions also responded to the fact that the authority does not comment on previous findings at the same facility when new supervisory activities are carried out. In their view, the PSA must deliver a much stronger response when nonconformities are not rectified.

5.2.5 The PSA's investigations

Investigations are a key component of the authority's risk-based supervisory activities and are carried out in addition to the companies' own internal investigations. Investigations are conducted in order to understand causality, courses of events and actual or potential consequences, and to prevent serious incidents from occurring in

54) Petroleum Safety Authority (2017) *Revisjonsprosedyre* (Norwegian only), last updated 13 March 2017.

the future. The authority also accumulates substantial competence and education through its investigations. The severity of the incident is the most important criterion when deciding whether to carry out an investigation.[55]

Table 2 Number of investigations carried out by the PSA in the period 2012–2017

Year	2012	2013	2014	2015	2016	2017
Number of investigations	5	6	4	10	8	5

Source: Petroleum Safety Authority

Table 2 shows that the PSA carried out 4–6 investigations per year, with the exception of 2015 and 2016 when the number of investigations was higher due to the occurrence of several serious incidents. In addition to the PSA investigating incidents, the companies conduct their own internal investigations. Equinor, for example, investigated the incidents at the Troll oil field and Mongstad in 2016.[56] The companies' investigations are typically completed before the PSA's investigation has been carried out. The police also investigate serious accidents, with professional assistance from the PSA.

The PSA conducted a thorough review of its own investigations from 2015 and 2016.[57] The authority states that investigations are essential to its efforts to prevent serious incidents and that they contribute to education. Both 2015 and 2016 were characterised by budget cuts and reorganisation within the industry, and therefore the authority investigated whether there was a correlation between this and the occurrence of serious incidents. The PSA came to the following conclusion:

> The gas leak at Mongstad and the serious well control incident on the Troll oil field last year are both examples of incidents in which budget cuts were a contributing factor.[58]

According to the PSA, the other six incidents investigated in 2016 did not have coinciding causes or a correlation with budget cuts.

The PSA does not investigate its own role in the investigations. The PSA believes that it learns from the investigations, but this is not put into writing in the investigation reports. New knowledge is shared internally and can also lead to changes in governing documents. According to the PSA, in the report from the joint committee in autumn 2017 the trade unions expressed a desire to establish an independent investigative committee.[59] The PSA notes that the Ministry of Labour and Social Affairs already has a mandate to appoint an investigative committee similar to the one appointed following the Alexander Kielland accident. The Ministry of Labour and Social Affairs has also recently examined the latest investigations from the PSA in order to evaluate what situations may require the appointment of committees. The PSA therefore feels that the current investigative model is the most beneficial. In the case of major accidents like Alexander Kielland, however, it is natural to appoint a committee. In 2010 the Ministry of Labour signed an agreement with the Accident Investigation Board of Norway for practical assistance

55) Report to the Storting 12 (2017–2018) *Health, safety and environment in the petroleum industry.*
56) Statoil (2017) *Well control incident Troll 31/2-G-4 B* (Songa Endurance). Investigative report, 4 January; Statoil (2017) *Lekkasje av H2 rikt prosessmedium i område A-1200 på Mongstad* (Norwegian only). Investigative report,13 January.
57) Petroleum Safety Authority (2017) *Looking for Lessons*, in "Safety — status and signals 2016–2017."
58) Petroleum Safety Authority (2017) *Looking for Lessons*, in "Safety — status and signals 2016–2017."
59) Ministry of Labour and Social Affairs (2017) *Health, safety and working environment conditions and trends in the Norwegian petroleum industry.*

when it is necessary to appoint an independent investigative committee. This agreement is currently under renegotiation.

Fact box 2 The Alexander Kielland accident

On 27 March 1980 the accommodation platform Alexander L. Kielland capsized when one its five legs sheared off in rough waters. Of the 212 people on board, 123 were killed and 89 were rescued. The accident took place on the Ekofisk oil field in the North Sea and was significant to the development of safety on the Norwegian continental shelf with regard to regulations, supervision schemes and the delegation of regulatory responsibility.

Source: Store norske leksikon and Petroleum Safety Authority

5.3 The PSA's use of sanctions

The PSA has the following legal sanctions at its disposal:[60]

- orders
- coercive fines
- suspension of operations
- penalties for violations

The sanctions available to the authority are individual decisions and must follow the applicable rules and principles for such cases (the Public Administration Act and non-statutory administrative law). Punishments and particular coercive measures fall under the jurisdiction of other authorities, but in certain cases the PSA can help in other ways, for example by assisting the police in the investigation of punishable conditions.

In the PSA's experience, in the vast majority of cases the companies follow up findings resulting from supervision in a constructive manner. According to the authority, the use of sanctions is connected to how the HSE model and regime for the petroleum industry are designed. There are constraints that affect the use of sanctions. The PSA states in an interview that orders are a very severe response, while with other supervisory authorities they are used more often and perhaps not perceived as being quite as severe. In the petroleum industry, orders are therefore issued in the event of serious findings. The authority's aim is to contribute to improvements, not to punish. In the PSA's experience, orders are often the most effective means of bringing about improvements. An overview of the use of legal responses is provided in Table 3.

60) The statutory responses are stated in the Petroleum Act, the Fire and Explosion Prevention Act, the Electrical Supervision Act (the latter two are applicable at onshore facilities beyond the jurisdiction of the Petroleum Act) and the Working Environment Act with supplementary regulations.

Table 3 Overview of the PSA's use of legal sanctions and assistance to the police in the period 2013–2017

Year	2013	2014	2015	2016	2017
Number of penalty-financed supervisory activities	94	119	132	116	121
Number of nonconformities in penalty-financed supervisory activities	276	301	259	207	225
Average number of nonconformities per penalty supervision	2,94	2,53	1,96	1,78	1,86
Number of orders	9	3	1	7	5
Number of coercive fines	0	0	0	0	0
Number of suspensions of operations	0	0	0	0	1
Number of police reports	0	0	0	0	0
Number of police cases with assistance from the PSA	4	6	3	5	10

Source: Petroleum Safety Authority

Use of orders

An order is a legally binding decision reached pursuant to the regulations of the area. According to the PSA's internal procedures for the use of legal sanctions, orders—as the weakest legal sanction at the authority's disposal—will be used to indicate that the regulatory breach in question is seen as serious with regard to HSE.[61] An order can also be used when it is necessary to respond severely to less serious regulatory breaches because the company has demonstrated insufficient ability or desire to rectify the same or similar regulatory breaches when the authority has used milder responses. Companies view orders as being far more serious, and they can have a much greater financial impact if they entail the suspension of production or a delay in the start of production.[62] In the PSA's experience, orders are often the most effective means of bringing about improvements.[63]

Typically, orders are discussed after supervision or as part of an investigation. The supervision leaders are given the authority to issue notifications and orders, and can therefore suspend activities immediately if needed. There is a thorough internal discussion regarding which sanctions are most appropriate and effective in each instance. Lawyers are involved in this process, and top management is always brought in if formal sanctions are being considered.[64]

Use of coercive fines

Coercive fines can be imposed if an order has not been complied with before the deadline set by the PSA. The purpose of this coercive tool is that the financial pressure will force the company to comply with the order as quickly as possible. The PSA has never used this tool.

Use of suspension of operations

A suspension of operations can be enacted based on safety considerations, and the aim is to stop an activity that presents an immediate danger. Suspension of operations

61) Petroleum Safety Authority (2017) Virkemiddelhåndbok — *bruk av virkemidler i tilsynet med helse, miljø og sikkerhet, internal guidelines* (Norwegian only), last updated 1 May 2017.
62) Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.
63) Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.
64) Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.

can also be used as a means to force the company to make the changes necessary for the activity to be conducted in accordance with regulations. [65]

Following the supervision of Goliat in September 2017, the PSA chose to suspend production on the platform until the regulatory breaches identified by the supervision were rectified. In principle, the PSA issued Eni Norge AS with an order to not resume production until the nonconformities were rectified. When the supervision took place, production on Goliat was stopped for maintenance work. In practice this meant a suspension of production, and the PSA listed it as a use of suspension of operations as a tool. This was the only time in the period 2013–2017 where the PSA used this tool.[66]

Penalties for violations

The PSA can impose penalties for violations on a company if someone who has acted on behalf of the company has violated provisions as stated in the first paragraph of Section 18-6 of the Working Environment Act. According to the PSA, penalties for violations have little effect because the companies involved have large cash flows. The penalty can be at most 15 times the public pension base rate. Such penalties can also only be imposed for breaches of the Working Environment Act. The PSA has not used this tool.

Police cooperation and reports

The PSA often participates as a specialist adviser in police investigations. This typically takes place parallel to the authority's own investigation. When the police closes a case, the authority is often requested to make a statement regarding prosecution and punishment from the police. Southwestern Police District has the most of these cases, and is responsible within the police for coordinating the response to offshore incidents.[67] The Rogaland public prosecutor's office is responsible for prosecution of all cases involving the continental shelf. Southwestern Police District emphasises that its collaboration with the PSA is very beneficial and that it is important for the police to be notified so that they can be made aware of cases and do their work.[68]

The PSA can report conditions to the police. Southwestern Police District noted in an interview that they have never had a situation reported to them by the PSA. The Rogaland public prosecutor's office noted in an interview that approximately 60 fines have been issued on the Norwegian continental shelf since 1986, but none of these cases were reported by the PSA. Southwestern Police District feels that sometimes they are too late in finding out about a case, and that this might be avoided if the case were reported by the PSA. Southwestern Police District is not briefed if the PSA has not identified anything in its supervisory activities that should be reported.

Southwestern Police District is not aware of the reason why the PSA never submits reports to them. The Rogaland public prosecutor's office refers to a 2014 meeting in which the PSA's reporting process was discussed. At this meeting, the public prosecutor was clear that they expected that cases of which the police should be aware would be reported. The PSA then said that they would begin to report cases, but four years later the authority still has yet to report one case. The Rogaland public prosecutor's office believes that the PSA does not think reports are one of the tools available to them, but considering the authority's clear message several years ago,

65) Petroleum Safety Authority (2017) *Virkemiddelhåndbok — bruk av virkemidler i tilsynet med helse, miljø og sikkerhet, internal guidelines* (Norwegian only), last updated 1 May 2017.
66) Petroleum Safety Authority (2017) *Order to Eni Norge — electrical safety and person in charge of electrical facilities*. Letter to Eni Norge AS, 6 October.
67) Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.
68) Verified minutes from meeting with Southwestern Police District, 12 March 2018.

Southwestern Police District was under the impression that the PSA would change course[69]

The PSA noted in an interview that reporting can be relevant in judging the most serious cases and where there is suspicion of criminal conditions. The PSA's own sanctions (such as orders) are primarily aimed at imposing upon the responsible party an obligation to rectify regulatory breaches. A report will not in and of itself impose such obligations on the responsible party, but any subsequent punishment may function as a tool for ensuring regulatory breaches are rectified. The outcome of a report depends on how it is processed by the police, the prosecuting authority and potentially the court, and is therefore not a tool with which the PSA has control over the outcome. According to the PSA, in cases where it is relevant to report, collaboration with the police has generally already been initiated at an early stage in the case. This is especially true for the follow-up of serious incidents where the PSA is both conducting its own investigation and providing technical assistance with the police investigation. In such situations, the authority works closely with the police and also receives the completed police cases to comment on whether they involve punishable violations of the regulations under the authority's jurisdiction. For cases that are already being processed by the police, the PSA sees reporting to be unnecessary.

The PSA notes that there is no rule about not reporting situations. For serious situations, reporting is considered. The PSA also has annual meetings with the police, and the feedback indicates that the police are satisfied with the collaboration, but that generally the findings of supervision are not actively shared with the police. The PSA has therefore made an agreement with the police that they will assess on a case-by-case basis whether serious findings should be shared with the police. The PSA also states that in several instances they have recommended corporate penalties in connection with the police's investigation of cases.

Use of special coercive measures
According to the Petroleum Act, there are several special coercive measures. The decision-making mandate for the coercive measures rests with other authorities, but the PSA can take the initiative to implement them. These coercive measures are as follows:

- *Revocation of licence (government)*
  The PSA can contact its own or another ministry for revocation.
- *Change of operator (Ministry of Petroleum and Energy)*
  The Ministry of Labour and Social Affairs can, on the advice of the PSA, recommend that the Ministry of Petroleum and Energy change operators on safety-related grounds.
- *Measures on the account and risk of the licensee (Ministry of Petroleum and Energy)*
  The PSA can, via the Ministry of Labour and Social Affairs, recommend measures that must be carried out by the Ministry of Petroleum and Energy.

The PSA did not take the initiative for the use of any of these tools during the period under investigation.

69) Verified minutes from meeting with Southwestern Police District, 12 March 2018.

5.4 The PSA's follow-up of incidents and reports of concern

5.4.1 The PSA's follow-up of incidents

The PSA has developed its own routines and procedures for how it will follow up notifications of incidents.[70] The procedure describes the PSA's role and responsibility from when they receive notification of an incident until the incident is resolved. Once the PSA has received notification of an incident, it is registered in the internal database (the incident database). According to the PSA, it is the duty emergency response officer who receives incident reports and makes sure that they are followed up further by the supervision management, supervision leader and area leaders. If necessary, the duty emergency response officer will establish an emergency preparedness organisation responsible for carrying out supervision of any ongoing situation, for example a well control incident that is not yet under control.

With regard to the procedure, the supervision leader is responsible for

- evaluating the degree of severity of the reported incident
- evaluating whether the PSA should investigate the incident
- informing top management and public affairs if necessary
- assigning an executive officer for each incident and indicating this in the incident database and in the authority's archive system, ePhorte

The supervision leader must also evaluate further follow-up based on a total assessment of previous incidents involving the same company or facility.

With regard to the procedure, the executive officer is responsible for following up the incident by filing all relevant case documents in the authority's archive system and ensuring the proper choice of follow-up alternatives. The latter means that, if necessary, the executive officer must contact the company to obtain supplementary information. The executive officer must also coordinate the follow-up and sign off on the case upon completed processing in the incident database and archive system.

The Management Regulations state how companies are to report different types of incidents. Serious incidents must always be reported by telephone, but others can be reported in writing. The PSA determines the incident's degree of severity when it is reported. All incidents in Category 2 or higher are reportable. The PSA sets the degree of severity in accordance with its own procedures:[71]

- high potential/major accident (5) – incidents that have led to, or have the potential to lead to, fatalities or major injuries or contamination. Typical follow-up is investigation;
- serious (4) – serious incidents that could be relevant for investigation. At minimum, the authority will evaluate whether to call a meeting with the company in order to be presented with their follow-up and measures;
- simpler follow-up (2) – other incidents within the PSA's jurisdiction. Follow-up is adjusted based on the type and severity of the incident, as well as experience with the company's own follow-up of the current incident and previous incidents;
- not reportable (1) – incidents that are beyond the PSA's jurisdiction. These will not be included in the analysis of trends.

70) Petroleum Safety Authority (2016) *Prosedyre for oppfølging av hendelser* (Norwegian only). Internal guidelines, last updated 1 December 2016.
71) Petroleum Safety Authority (2016) *Prosedyre for oppfølging av hendelser* (Norwegian only). Internal guidelines, last updated 1 December 2016.

Table 4 Number of reportable incidents reported to the PSA per year, 2011–2017

Year	Number
2011	758
2012	744
2013	740
2014	650
2015	616
2016	537
2017	497

Source: Petroleum Safety Authority

The number of reportable incidents received by the PSA decreased significantly in the period 2011–2017; see Table 4. The PSA states that it has a good overview of what is reported. According to the authority, there are approximately 10–15 incidents per week. The follow-up can be traced in the authority's systems (the incident database). According to some of the trade unions, the companies redefine some incidents' degree of severity in order to avoid negative attention, and in some cases fail to report entirely. The PSA stated in an interview that the issue has been addressed with the companies. The authority states that it receives requests for access to information regarding all incidents, and that in some cases this means that the companies under-report the details of the incident to avoid negative media coverage. According to the PSA, there is always a danger of under-reporting from the companies, but nevertheless the authority points out that this is an industry with a high degree of reporting.

The case studies show that the PSA processes and follows up incidents in accordance with its internal procedures for receiving and processing incidents. For example, the case studies of Goliat, Nyhamna and Mongstad show that the PSA followed up incident reporting with supervision and investigations. In certain audit reports, however, it appears that the PSA discovered incidents that should have been reported, but were not. Here are some examples from the years 2016 and 2017:

- supervision of platforms Ekofisk K and Ekofisk B, 4 October 2016 — failure to report danger and accident situations
- supervision of Kårstø onshore facility, 16 December 2016 — failure to report danger and accident situations
- supervision of Grane platform, 15 March 2017 — failure to report danger and accident situations
- supervision of Kristin platform, 5 May 2017 — failure to report gas leak
- supervision of Edvard Grieg, 3 July 2017 — failure to report danger and accident situations
- supervision of Deepsea Stavanger, 29 November 2017 — failure to report incidents with loss of primary barriers and falling objects
- supervision of Goliat, 30 October 2017 — failure to report the impairment of a vital safety-related function

5.4.2 The PSA's follow-up of reports of concern

A report of concern is a notification to the authorities of reprehensible conditions in the workplace. Based on the requirements of the Working Environment Act, the PSA has developed its own internal procedures for how a report of concern is to be followed up.[72]

72) Petroleum Safety Authority (2017) *Behandling av varsler om kritikkverdige forhold i petroleumsnæringen* (Norwegian only). Internal guidelines, last updated 7 September 2017.

The document describes the procedure for processing the reports that the PSA receives from workers in the industry regarding reprehensible conditions or conditions they believe to be in breach of laws and regulations.

Table 5 provides an overview of how many reports of concern the PSA receives each year, and how these are distributed across different topics. The PSA believes that it does not receive many reports of concern in comparison to other authorities such as the Labour Inspection Authority.

Table 5 Overview of reports of concern received 2011–2017, arranged by topic

	Reports of concern	Organisational and psychosocial working environment	Technical safety	Physical working environment	Emergency prepared-ness	Other
2011	**23**	56 %	23 %	13 %	4 %	4 %
2012	**18**	77 %	11 %	6 %	6 %	0 %
2013	**13**	38 %	38 %	8 %	8 %	8 %
2014	**12**	50 %	34 %	8 %	0 %	8 %
2015	**20**	75 %	15 %	0 %	5 %	5 %
2016	**30**	57 %	14 %	13 %	3 %	13 %
2017	**29**	48 %	41 %	4 %	-	7 %
Average	**19,3**	57 %	25 %	9 %	5 %	8 %

Source: Petroleum Safety Authority

The table shows that the number of reports of concern submitted to the authority has increased in recent years, and that the majority of the reports of concern relate to the organisational and psychosocial working environment. According to the PSA's annual report for 2017, the reports relate to lack of correlation between resources and work tasks, deficient employee participation, pressure on working hours, lack of reporting culture and challenges involving education and competence.

Case file review of reports of concern

To gain insight into the PSA's follow-up of reports of concern, 95 cases that were reported to the PSA were reviewed. This includes all reports of concern relating to the case studies, and all reports of concern submitted to the authority in the period 2015–2017.

Table 6 shows the results of the review of information in the PSA's archive system in ePhorte and in Planverktøyet.

Table 6 Documentation of case processing in ePhorte and Planverktøyet

	Confirmation of Documented Result received notification		Documented investigated facts		Result of follow-up	
	ePhorte	Planverktøy	ePhorte	Planverktøy	ePhorte	Planverktøy
Yes	69	82	63	74	81	92
No	17	4	12	1	11	0
Not relevant	9	9	20	20	3	3
"No" percentage	20 %	5 %	16 %	1 %	12 %	0 %

Source: Office of the Auditor General

The table shows three aspects of case processing, based on the PSA's internal procedures for the processing of such cases:

- whether the sender was notified that the report was received by the PSA
- whether the PSA has investigated the factual conditions of the case, for example by requesting documentation or asking the company about the conditions
- whether there is documentation of how the report was followed up, for example documentation that supervision has been carried out, that the incident led to the use of sanctions or that the case was dropped

The number of reports in the categories "yes" and "no" is based on whether it was documented in ePhorte that the PSA had completed this aspect of the case processing. For some of the reports, not all of the aspects are relevant. For example, it is not possible to confirm the receipt of a report of concern if the sender was anonymous. Similarly, it would not be natural to investigate facts relating to situations beyond the PSA's jurisdiction. In such cases they would refer the sender to the responsible authority. "'No' percentage" is calculated based on the total number of "yes" and "no" entries for each aspect, meaning that cases marked "not relevant" are excluded.

Table 6 shows that in 20 per cent of cases, the archive system does not contain information about whether the sender received confirmation that the report was received by the PSA. In accordance with the authority's own procedures, the sender should receive confirmation that their report was received. In the analysis, the limit of when a response to the sender can be counted as confirmation of a received report of concern is one month after the report is registered with the PSA.[73] The information in Planverktøyet indicates that the portion of senders who did not receive confirmation is just 5 per cent.

In 16 per cent of cases, it is not documented in ePhorte whether the PSA investigated the facts of the report of concern. This is required by the authority's internal procedures for the follow-up of reports of concern. Based on information from Planverktøyet, the portion of cases for which the authority did not investigate the facts is just 1 per cent.

In approximately 12 per cent of the cases there is no documentation of how the PSA handled the case, and it is not possible to assess based on the information in ePhorte whether the PSA did a good job of following up on the case. Based on information from Planverktøyet, the results of follow-ups are documented for all cases.

73) The requirements for confirmation have been changed in the procedure. The latest requirements are from 1 May 2018. Before 5 May 2017 the requirement was that the sender must receive a response as to how the case was being handled. The reports of concern are assessed in relation to the requirements that were applicable at the time of the report.

Differences in information between the two systems shows that in several instances the documentation recorded in ePhorte does not show what was actually done in processing the reports of concern. This only appears in the PSA's internal case processing system.

The PSA stated in an interview that in the period 2014/2015 they had a project in which they evaluated how reports of concern had been processed in the three preceding years. The review showed that the reports of concern were handled well for the most part, but that in some instances the processing was not adequately documented and the cases were written off. A similar review was conducted in 2016. According to the PSA, the review showed improvement both in procedure and in the processing of reports of concern. Another view was that the processing of reports of concern was so complex that it was necessary to have more internal training on the subject.[74] To ensure consistent processing of all reports of concern, training is now carried out internally within the authority. The PSA continued the project in 2017 due to increased awareness surrounding reports of concern and as a result of a new paragraph in the Working Environment Act in effect from 1 July 2017.[75] Since 2016, reports of concern have also been a topic at weekly supervision meetings to ensure that the topics are followed up by the supervision teams.[76]

5.5 The PSA's processing of consent and AoCs

Consent scheme

In order to carry out activities on the Norwegian continental shelf or onshore facilities, the operator must often apply for consent from the PSA. The activities requiring consent are listed in Section 25 of the Management Regulations, where it states that the operator must have consent before the commissioning of facilities, before major remodelling or changes to the intended use, before significant changes in activities resulting from new requirements or licences and before the use of facilities beyond their planned lifetime. In addition, consent is required for a number of offshore petroleum activities: exploratory drilling, manned underwater operations, drilling deeper than 200 m below the seabed, disposal of a facility and removal or relocation of a facility of vessel with a significant safety-related function.

Consent from the PSA expresses the authority's trust that the activities can be conducted within the framework of the regulations and in line with the information provided in the application. There are specific requirements concerning what must be included in an application for consent, depending on what type of activity the consent is being sought for.[77] Consent is not a guarantee or approval from the PSA, and it is always the operator's responsibility to ensure that safety is maintained on the installations and that the activities are carried out within the regulatory framework.

According to the PSA, an application for consent to commission a facility must include documentation of the decision-making process that took place within the company. It is not the PSA's decision to commence an activity; the authority's role is to grant its consent that the decision has been made on reasonable grounds and will contribute to the activity being carried out within the framework of HSE regulations. When reviewing

74) Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.
75) Petroleum Safety Authority (2018) Annual Report 2017, p. 24.
76) Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.
77) Management Regulations, section 26.

applications for consent to commission a facility, the authority will be able to base the processing of consent on experiences gained from supervision of the construction site and will have been able to look at the design and planning. The application itself therefore makes up a lesser, yet central, part of the authority's decision-making basis when processing applications for consent.[78]

Table 7 Overview of consents granted in the period 2014–2017, arranged by topic

	2014	2015	2016	2017
Exploratory drilling	34	34	22	27
Mobile offshore units — other	41	32	18	30
Permanent/pipelines: use, drilling, modifications	26	21	14	14
Lifetime consent	6	7	4	2
Other	7	4	20	11
Total	**114**	**98**	**78**	**84**

Source: Petroleum Safety Authority

As Table 7 shows, consent is granted to rather diverse types of activities. There is great variation in how comprehensive and complex the applications for consent are. For example, an application for consent to extend the lifetime of an existing platform, or to commence production on a newly installed platform, will be much more complex and comprehensive than an application for consent to use a floatel for accommodation.

Section 26 of the Management Regulations defines what a company's application for consent must include. There are also supplementary guidelines for this paragraph that further specify the contents of the application. The PSA expressed in an interview that the vast majority of applications for consent fulfil the formal requirements detailed in the Management Regulations, and that very rarely does the PSA have to deny an application because it contains errors or is not completed correctly.[79]

5.5.1 Acknowledgements of compliance

The operator of a field often rents mobile units from other companies to carry out various activities, such as drilling rigs and accommodation units. In order to use a rented drilling rig for exploratory drilling, the operator must have consent from the PSA to begin using it.[80] So that the PSA and the companies avoid having to carry out a complete review of the drilling rig each time it is used for a new task, the owner of the drilling rig must apply to the PSA for an acknowledgement of compliance (AoC).

An AoC means that the PSA trusts that petroleum activities can be conducted using the rig within the regulatory framework. The AoC is issued to the company that owns the facility, and the owner then lets the facility out to an operator. The AoC will then be part of the documentation submitted in the operator's application for consent to use the drilling rig for drilling operations. AoCs are therefore a form of prequalification that help to simplify the processing of consent as well as providing the companies with more predictability when renting mobile units. AoCs are obligatory for drilling rigs, accommodation units, mobile production platforms and well intervention units. An exception is mobile units where the operator itself is responsible for operation and

78) Verified minutes from meeting with Petroleum Safety Authority, weeks 47 and 48 of 2017.
79) Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.
80) The facilities included in the AoC scheme are defined in the Framework Regulations Section 25.

storage vessels.According to the PSA's website there are a total of 63 mobile units with AoCs.[81] Table 8 shows the facilities that were granted AoCs in the period 2013–2017.

Table 8 AoCs issued by the PSA, 2011–2017

2013	2014	2015	2016	2017
Island Innovator	Maersk Interceptor	Songa Endurance	Floatel Endurance	Maersk Invincible
Songa Trym	Petrojarl Knarr FPSO	Songa Equinox	Safe Zephyrus	Deepsea Stavanger
	Rowan Viking	Safe Boreas	Songa Enabler	Askeladden
	West Linus	Maersk Integrator	Songa Encourage	Askepott
	Maersk Intrepid			
2	**5**	**4**	**4**	**4**

Source: Petroleum Safety Authority

The PSA has internal procedures and guidelines for the processing of AoCs.[82,83] There are also guidelines concerning what the application should include, and how it should be structured, prepared by Norwegian Oil and Gas.[84] An application for an AoC is comprehensive and detailed, and the PSA must be able to trust that the information stated in the application is correct. The PSA states in an interview that supervision of the facilities and of the owner's systems and plans is carried out as part of processing the case.

81) *Mobile facilities with AoC, overview of mobile facilities with AoC.* <http://www.ptil.no/facilities-with-aoc/category953.html> [15 August 2018].
82) Petroleum Safety Authority (2017) *Behandling av SUT-søknader* (Norwegian only), dated 1 May 2017.
83) Petroleum Safety Authority (2017) *Behandling av SUT-søknader* (Norwegian only). Guidelines concerning procedures for processing of applications for acknowledgement of compliance, dated 1 May 2017.
84) Norwegian Oil and Gas (2011) *Handbook for application for acknowledgement of compliance (AoC)*.

6 Goliat

6.1 Background

Goliat FPSO (Floating, Production, Storage and Offloading) was built at the Hyundai shipyard in South Korea on the request of Eni Norge AS (hereafter Eni). The platform arrived at Hammerfest in April 2015. At this point the platform was already two years behind schedule, and the development of the oil field had cost approximately 18 billion NOK more than was stated in the plan for development and operation.[85] Since Goliat FPSO arrived in Norway in February 2015, there have been 57 reportable incidents on board the platform, three of which the PSA categorises as serious. In the same period, the PSA received 14 reports of concern regarding Eni and conditions on board the platform. The PSA has followed Goliat since the beginning and has carried out 24 supervisory activities, from the planning and design phase up to completion and operation. According to the PSA, these are high figures in comparison with the authority's follow-up of other similar facilities on the Norwegian continental shelf. Goliat FPSO produces oil from the Goliat field, which is located in the Barents Sea roughly 85 km north-west of Hammerfest. The field was discovered in 2000, and on 8 May 2009 the Storting approved the Plan for development and operation (PDO) for the Goliat field.[86] The Norwegian Petroleum Directorate wrote in its assessment of the PDO that "there is documentation that the development can be carried out within the cost and time framework stated in the plans and that, with the given assumptions, the economic aspect of the project is satisfactory".[87]

The licence partners on the Goliat oil field are Eni with 65 per cent. and Equinor Energy AS (hereafter Equinor). with 35 per cent. Eni has operator responsibility and has been responsible for development, operations and production on the field. Eni has been involved with exploratory activity on the Norwegian continental shelf since 1964, but has not previously been the operator for development and operation of an oil field.

Goliat FPSO is regarded as the world's largest and most advanced floating production unit, and it is the first platform to produce oil in the Barents Sea.[88] The Barents Sea is considered to be vulnerable and has demanding weather conditions. The Arctic climate was part of the reason why the platform has a non-traditional design and why several new, untested solutions were chosen. In order to protect the processing unit from the cold of the Barents Sea it was built into the platform. The processing unit processes and refines oil and gas from the reservoir so that it can be stored and transported for further refinement. A consequence of the unit being in-built is that any gas leaks will be collected and concentrated to a greater extent than with a more open platform construction. Clouds of gas can therefore reach dangerous concentrations more quickly. This places very high demands on gas detection equipment and ignition source control.[89] Due in part to these conditions, the PSA has, in its own words, followed the development of the Goliat oil field and the construction of the platform closely, ever since the PDO was adopted by the Storting in 2009.

85) Proposition to the Storting no. 64 (2008–2009) *Utbygging og drift av Goliatfeltet* (Norwegian only); see Innst. S. nr. 363 (2008–2009) *Innstilling fra energi- og miljøkomiteen om utbygging og drift av Goliat-feltet* (Norwegian only).
86) Proposition to the Storting no. 64 (2008–2009) *Utbygging og drift av Goliatfeltet* (Norwegian only); see Innst. S. nr. 363 (2008–2009) *Innstilling fra energi- og miljøkomiteen om utbygging og drift av Goliat-feltet* (Norwegian only).
87) Proposition to the Storting no. 64 (2008–2009) *Utbygging og drift av Goliatfeltet* (Norwegian only); see Innst. S. nr. 363 (2008–2009) *Innstilling fra energi- og miljøkomiteen om utbygging og drift av Goliat-feltet* (Norwegian only).
88) Teknisk Ukeblad, online edition 16 February 2015: *Dette er unikt med Goliat* (Norwegian only).
89) Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.

When the Goliat platform was commissioned, it was already two years behind schedule and the development of the oil field had cost approximately 18 billion NOK more than planned. Photo: © Eni Norge

The case study of Goliat helps to answer all the audit problems regarding the PSA's supervisory practices. It demonstrates how the PSA plans and carries out supervision in different phases (planning and operation) and how it follows up to ensure that the operator rectifies any regulatory breaches. It appears that there have been persistent challenges facing Goliat FPSO, and regulatory breaches that were pointed out were not rectified. The PSA issued Eni with five orders with respect to conditions relating to Goliat FPSO, but it appears that a number of regulatory breaches were not rectified. The authority received an unusually high amount of reports of concern regarding conditions on Goliat, and a review of these sheds light on whether the PSA upholds its own procedures and how the authority follows up reports of concern regarding the operator company. There have been many incidents on Goliat, and three of them have been serious. This case study also describes how the PSA followed up on these serious incidents through investigations. In order to commence the production of oil, Eni was dependent on several consents from the PSA, but the most important was the consent to commission Goliat. The case study therefore includes the PSA's processing of the application for consent in connection with the commencement of operations and production.

6.1.1 Project engineering and construction phase

Hyundai Heavy Industries, which received the contract to build the platform in 2010, had at that time little experience with delivering production facilities to the Norwegian continental shelf.[90] The PSA had little experience with production facilities of this type and with in-built processing units. The PSA had many meetings with Eni at which they discussed how to handle the risk of explosions with such a concept. In order to strengthen its competence in operations in t he northern regions, the PSA hired an external consultant to prepare a course about challenges in the Arctic. The PSA also

90) Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.

brought in external competence within fire and explosion prevention. In addition, AS Norske Shell was consulted due to their experience with petroleum activities in Arctic regions.[91]

According to the PSA, the construction phase was characterised by design changes, uncertainty surrounding plans and deliveries, poor quality of construction and craftsmanship in the shipyard, delayed deliveries and major cost overruns. The problems of the early phase spread to the operating organisation, and according to the PSA and Eni, several of the challenges present on the platform after production began were the result of the work carried out in the shipyard.[92]

In the beginning of 2014, Eni planned to transport the facility from South Korea to Norway. Findings from supervision and from project status meetings with Eni indicated that much work on the facility remained to be done. Therefore, at a licence meeting in 2014 the PSA recommended that Eni re-evaluate the plan for the remaining work prior to transportation to Norway. The PSA notes that it is not usual for them to give such recommendations on important decision-making matters in licence meetings. The recommendation was supported by the Norwegian Petroleum Directorate and the licence partner, Equinor. Eni chose to follow the recommendation, and Goliat therefore stayed in South Korea longer to undergo further work in the shipyard. This way Eni would avoid the risk of a large amount of work remaining to be done offshore.[93]

6.2 Consent to commission Goliat

The application for consent to commission Goliat FPSO was sent to the PSA on 13 February 2015. The same day, Goliat FPSO began its journey from the shipyard in South Korea to Hammerfest. At this time the platform was not completed, and the remaining work was to be carried out on the journey to Norway, in Hammerfest and at the platform's permanent location on the Goliat oil field in the Barents Sea.[94] The plan was to instal the platform in May 2015 and to start production of oil in July 2015.[95] Eni expected to reach a full production volume of 100,000 barrels per day by the end of 2015.[96] Goliat FPSO was installed on the field in May, but at that time the PSA was still processing Eni's application for consent, and the start of production was postponed pending consent. The PSA took a long time to process the application for consent in order to do a thorough job based on the experience they had at the time. According to the PSA, this was an unusually long case processing time for consent to use a facility.

6.2.1 The PSA's previous experiences with the Goliat project

The PSA conducted 14 supervisory activities concerning Goliat in the period before the application for consent was received on 13 February 2015, which covered the following issues:

- Barriers and process integrity: The PSA emphasised that Eni needed to have control of ignition sources in the processing unit, because they had found problems in this area in previous supervision of the platform.[97,98]

91) Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.
92) Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.
93) Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.
94) Teknisk Ukeblad, online edition 13 February 2015: *I dag seiler Goliat fra Korea* (Norwegian only).
95) Teknisk Ukeblad, online edition 7 May 2015: *Nå er Goliat på vei ut i Barentshavet* (Norwegian only).
96) Teknisk Ukeblad, online edition 22 April 2015: *Eni-sjefen om Goliat: 100 000 fat om dagen før årsskiftet* (Norwegian only).
97) Petroleum Safety Authority (2014) *Audit of technical and operational barriers on Goliat FPSO*, 14 March.
98) Petroleum Safety Authority (2013) *Rapport etter tilsyn med tekniske og operasjonelle barrierer på Goliat FPSO* (Norwegian only), 11 June.

- Organisation and collaboration: Insufficient collaboration within Eni's organisation between participants in the various project phases, and poor employee participation. The PSA writes the following in an audit report from 2013: "There is significant room for improvement with regard to interaction and the flow of information between the project and the operating organisation."[99] There were also nonconformities identified concerning employee participation during supervision in 2011, and improvement points were identified in 2014.[100,101]
- Procedures for and education regarding how different platform tasks should be carried out. The project could not point to prepared procedures, an overview of nonconformities, activity descriptions or working environment activities in the construction and completion phase of the project.[102,103]

The PSA granted consent for commissioning Goliat despite the fact that the safety of the platform had not yet been properly guaranteed. Photo: © Eni Norge

6.2.2 The application for consent

Eni received partial consent to commission the accommodation and the cranes on the platform on 20 April 2015, so that the platform could house personnel and store supplies and materials on board.

In processing Eni's application for consent to commission Goliat, the PSA made use of experiences and information from supervision of the construction site and meetings with Eni regarding design and planning in the early phases in order to obtain a

99) Petroleum Safety Authority (2013) *Rapport etter tilsyn med driftsforberedelser for Goliat FPSO* (Norwegian only), 13 March.
100) Petroleum Safety Authority (2011) *Rapport etter tilsyn med ivaretakelse av arbeidsmiljø, materialhåndtering og beredskap i design av Goliat* (Norwegian only), 22 June.
101) Petroleum Safety Authority (2014) *Rapport etter tilsyn med styring av arbeidsmiljø i ferdigstillelsesfasen av Goliat-prosjektet* (Norwegian only), 23 June.
102) Petroleum Safety Authority (2012) *Rapport etter tilsyn med design av Goliat — materialhåndtering og arbeidsmiljø* (Norwegian only), 20 April.
103) Petroleum Safety Authority (2014) *Rapport etter tilsyn med styring av arbeidsmiljø i ferdigstillelsesfasen av Goliat-prosjektet* (Norwegian only), 23 June.

comprehensive image of the situation for Goliat FPSO. The PSA obtained further information about conditions on the platform through supervision and participation in licence meetings.Gjennom tilsyn og gjennom deltakelse i lisensmøter fikk Petroleumstilsynet ytterligere informasjon om forholdene på plattformen.

Attached to the application for consent is a statement signed by the coordinating chief safety representative, chief safety representative and safety representative.[104] In the statement, the safety representatives list several conditions that they are critical of, including insufficient employee participation in several decision-making processes regarding working languages and accommodation conditions. The safety representatives also expressed concern that too much work remained outstanding before the platform was completed. They note that several work tasks were not completed even though they were marked as completed in Eni's systems. Therefore, it was unclear which work tasks remained to be done, and it could appear that there was less work outstanding than was actually the case. The statement goes on to note that employees have had experiences in which Eni did not manage to make realistic plans for progress and completion in the project phase. In other words, the safety representatives' statement calls attention to serious deficiencies in parts of the application for consent.

The PSA conducted five supervisory activities with Eni in the case processing period before the consent was granted (in the period 15 February 2015 to 19 January 2016). In the case processing period, the PSA also received seven unique reports of concern regarding various conditions on Goliat.

6.2.3 Supervision in connection with the processing of the application

In connection with the processing of the application for consent, the PSA carried out supervision of areas where there had previously been somewhat large challenges. The findings of these supervisory activities indicated that there were still problems in two areas in particular: logistics and barriers (including electrical/ignition source control).

During an audit of logistics in June 2015, the PSA found that Eni had not rectified regulatory nonconformities, even though this was marked as completed in Eni's systems. No measures were carried out that could indicate that the nonconformities were rectified, and the information about completed improvements in Eni's system was therefore untrustworthy. In January 2016 the PSA discovered a further nine nonconformities and one improvement point within logistics and employee participation. Several of the conditions were identified in previous supervisory activities dating back to 2012 and 2014 in the shipyard in South Korea and six months earlier on board the facility (18 June 2015).[105,106,107] Several of the conditions had been reported to Eni by employees, but this did not result in any changes. The PSA also noted in its supervision that employee participation at Eni was poor, and that the collaboration between the operating organisation and the project organisation was problematic.

In September 2015 the PSA carried out an audit of electrical facilities where they discovered nine nonconformities and eight improvement points. The PSA's audit report notes the following: "Based on observations, conversations and information we received, it is our impression that at the time of the supervision Eni did not have a sufficient overview of the scope of remaining work connected with the completion of the electrical

104) Eni Norge AS (2015) *Application for Consent to Put Goliat Facilities into Service*. Letter to the Petroleum Safety Authority, 13 February.
105) Petroleum Safety Authority (2012) T*ilsyn med materialhåndtering og arbeidsmiljø Goliat FPSO*, (Norwegian only), 3 September.
106) Petroleum Safety Authority (2014) *Tilsyn med materialhåndtering Goliat FPSO* (Norwegian only), 23 January.
107) Petroleum Safety Authority (2015) *Tilsyn med forberedelse til drift innenfor logistikk Goliat FPSO* (Norwegian only), 18 June.

facility."[108] A significant nonconformity is that at that time Eni did not have control over all ignition sources. Insufficient ignition source control had been recurrent in several previous supervisory activities..[109,110,111]

The PSA received several reports of concern regarding the electrical system on Goliat and the organisation of crane and lifting operations. The problem with work tasks being recorded as complete when in reality they were not was also reported several times to the PSA by one of the trade unions at Eni.

6.2.4 The involvement of Equinor as licensee

The PSA conducted several meetings with Eni between February and December 2015. In the meetings, the PSA was presented with documentation regarding the status of various systems on board the platform.[112] Based on information from the meetings and on the PSA's previous experience with uncertainty surrounding plans, the status of equipment critical to safety and remaining work on the platform, the authority sent a letter to Eni on 8 December 2015.[113] In the letter, the PSA stated that uncertainty surrounding electrical systems and ignition source control contributed to the fact that Eni's application for consent took a long time. To confirm that the problems with the aforementioned conditions were rectified, the PSA requested the following documentation from Eni:

> "documentation showing that all safety systems, including the system for ignition source control, have been tested and found to be in working order. Furthermore, documentation must be submitted showing that equipment and safety systems used in areas with a risk of explosion are checked in accordance with the relevant requirements including Section 78 of the Facilities Regulations on ATEX."[114]

The same day, the PSA requested that Equinor provide an assessment of the operator Eni's decision-making basis for the commissioning of Golia.[115] As a licensee, Equinor is obliged to ensure that all who carry out work for them uphold the provisions and requirements of the laws and regulations.[116] According to Equinor, it was unusual for them as a partner to be involved in the processing of an application for consent.[117]

Eni replied in writing to the PSA's request on 7 January 2016.[118] The response included a plan for which activities were to be carried out before the commencement of production on Goliat FPSO. The plan included mapping the status of and nonconformities relating to critical safety systems, ignition source control and employee participation, and carrying out relevant measures to rectify the identified nonconformities. On 8 January Equinor sent a letter to the PSA in which they noted that Eni's plan "includes the activities that must be carried out before Goliat can

108 Petroleum Safety Authority (2015) *Tilsyn med elektriske anlegg på Goliat FPSO* (Norwegian only), 11 September.
109) Petroleum Safety Authority (2012) *Tilsyn med tekniske og operasjonelle barrierer på Goliat FPSO*, (Norwegian only), 23 March.
110) Petroleum Safety Authority (2013) *Tilsyn med tekniske og operasjonelle barrierer på Goliat FPSO* (Norwegian only), 24 April.
111) Petroleum Safety Authority (2014) *Audit of technical and operational barriers on Goliat FPSO*, 14 March.
112) Minutes from meetings between Eni and the Petroleum Safety Authority, 23 February 2015, 8 June 2015, 20 August 2015, 13 October 2015, 30 October 2015 and 4 December 2015.
113) Petroleum Safety Authority (2015) *Vedrørende samtykke til å ta i bruk Goliat FPSO* (Norwegian only). Letter to Eni Norge AS, 8 December.
114) Petroleum Safety Authority (2015) *Vedrørende samtykke til å ta i bruk Goliat FPSO* (Norwegian only). Letter to Eni Norge AS, 8 December.
115) Petroleum Safety Authority (2015) *Statoil sin vurdering i forbindelse med oppstart av Goliat FPSO* (Norwegian only). Letter to Statoil, 8 December.
116) Petroleum Act Section 10-6, Framework Regulations Section 7.
117) Verified minutes from meeting with Statoil, 12 March 2018.
118) Eni Norge AS (2016) *Concerning Consent to put Goliat FPSO into Service*. Letter to the Petroleum Safety Authority, 7 January.

commence production".[119] Equinor believed that the plan was feasible, yet possibly somewhat optimistic with regard to the schedule for execution.[120]

Equinor went through the points of the plan on its own to evaluate whether Goliat FPSO was ready to begin production. Equinor's report from this verification was submitted on 12 February 2016. Equinor found that there was quite a lot of work still remaining to be done and that Eni did not have a full overview of what this work was. In addition, there was a lack of common understanding within Eni as to what work was outstanding before the platform could be put into use, including within the work of surveying and controlling sources of ignition. The mandate for the working group at Eni that would be responsible for this was unclear, and there were various opinions at Eni regarding how far they had come with surveying and controlling sources of ignition.[121]

The PSA states that they had less trust in Eni than they normally would have in an operator, and that they therefore asked Equinor to review the plans prior to commissioning.[122] The PSA states that they assumed that the findings in Equinor's report were followed up by Eni and Equinor. At this time the PSA believed that they did not have grounds to verify Equinor's assessment, and they trusted that the responsibility to follow up these findings was addressed by Eni. The PSA therefore saw no need to verify the contents of Equinor's review.[123]

Both the PSA and Equinor state that there were extensive meetings in the time prior to the commissioning. According to Equinor, the basis for their assessments was therefore known to the PSA. Equinor informed the PSA that there would be regularity problems after the commencement of operations, but Equinor did not see this as a safety issue.[124]

6.2.5 The PSA's assessments and prerequisites for consent

On 19 January, 2016, the PSA granted consent to put Goliat into use based on documentation in the application and clarifications made during the processing of the case. At this time Eni had not carried out all the activities and measures in the completion plan. The PSA therefore granted consent under the following conditions:

- that the activities described by Eni before and after the start of production be completed; see letter from
- 7 January 2016 with appendix
- that Equinor's verification be carried out and followed up in the licence, and that the PSA finally receive a response from Equinor as requested in the letter dated 8 December 2015 prior to commencing activities

In addition, Eni was to provide the PSA with written confirmation that the facility was ready to commence operations prior to commissioning.[125]

Eni received an emission permit from the Norwegian Environment Agency on 20 January 2016,[126] and neither the County Governor of Rogaland nor the Norwegian

119) Statoil (2016) *Vedrørende samtykke til å ta i bruk Goliat FPSO* (Norwegian only). Letter to the Petroleum Safety Authority, 9 January.
120) Verified minutes from meeting with Statoil, 12 March 2018.
121) Statoil (2016) *Report – Statoil Goliat FPSO Review*, 12. februar.
122) Petroleum Safety Authority (2018) *Skriftlig svar på spørsmål fra sluttintervju* (Norwegian only). Email to the Office of the Auditor General, 18 June.
123) Petroleum Safety Authority (2018) *Skriftlig svar på spørsmål fra sluttintervju* (Norwegian only). Email to the Office of the Auditor General, 18 June.
124) Verified minutes from meeting with Statoil, 12 March 2018.
125) Petroleum Safety Authority (2016) *Samtykke gis til å ta i bruk Goliat FPSO med tilhørende installasjoner* (Norwegian only). Letter to Eni Norge AS, 19. 19 January.
126) Norwegian Environment Agency (2016) *Tillatelse etter forurensningsloven for produksjon og drift på Goliatfeltet* (Norwegian only). Letter to Eni Norge AS, 20. 20 January.

Environment Agency had objections to the PSA's consent[127,128] Eni also received consent for extraction of oil from the Norwegian Petroleum Directorate.[129] The letter of consent from the Norwegian Petroleum Directorate is dated 20 January 2016, but a correction to this letter dated 21 January 2016 notes that the Norwegian Petroleum Directorate's consent was processed and granted at an earlier date. The original letter of consent from 20. January 2016 states: "The commencement of operations on Goliat FPSO is planned for the end of July this year."[130] This corresponds with the start time in Eni's plan as of February 2015. In the correction to the letter of consent, it states that "it is planned for operations to commence at Goliat FPSO in February 2016".[131] According to the Norwegian Petroleum Directorate's website, the consent for extraction was ready on 4 September 2015.[132] It is also specified that final consent to commence operations also requires approval from the PSA and the Norwegian Environment Agency.

The Ministry of Petroleum and Energy wrote in a plan for development and operation in 2009: "The development of Goliat, with current expectations for costs, production and oil prices, is considered by the licensees to be marginally profitable."[133], They also noted that low oil prices and increased investment costs would threaten the project's profitability.[134] In 2016, the investment costs for Goliat were over 50.7 billion NOK (in 2016 NOK values), corresponding to an overrun of 18.1 billion NOK in relation to the calculations in the plan for development and operation.[135] In addition, the price of oil was nearly halved in autumn 2014. The Norwegian Petroleum Directorate carried out new calculations of Goliat's profitability in October 2015,[136], and these showed that the Goliat oil field was marginally profitable under two conditions: that production began in November 2015, and that it would be possible to export the gas on the field.[137]

On 11 March 2016 Eni sent a letter to the PSA stating that they were ready to begin production on Goliat. The same day, Equinor sent confirmation that Eni had done what was necessary to be able to carry out safe petroleum production. The day after the letters were sent to the PSA, 12 March 2016, the production of oil began at Goliat FPSO. Both Eni and Equinor viewed the conditions for consent as fulfilled when they notified the PSA of the commencement of production on 11 March 2016. Equinor stated in an interview that they were surprised that Goliat entered into operation so quickly after consent was granted, and that they had expected the completion work to take longer.[138] The official opening of the Goliat oil field took place on 18 April 2016. At this time, production on the platform had been suspended due to a gas leak the day before.

127) County Governor of Rogaland (2015) *Tilbakemelding til Petroleumstilsynet angående søknad fra Eni Norge til oppstart av produksjonsoperasjoner med innretningen Goliat på Goliatfeltet (PL 229) i Barentshavet* (Norwegian only). Letter to the Petroleum Safety Authority, 18 March.
128) Norwegian Environment Agency (2016) *Miljødirektoratets uttalelse til søknad om samtykke Goliat* (Norwegian only). Letter to the Petroleum Safety Authority, 19 January.
129) Norwegian Petroleum Directorate (2016) *Samtykke til oppstart av Goliat FPSO med tilhørende produksjonsfasiliteter* (Norwegian only). Letter to Eni Norge AS, 20 January.
130) Norwegian Petroleum Directorate (2016) *Samtykke til oppstart av Goliat FPSO med tilhørende produksjonsfasiliteter* (Norwegian only). Letter to Eni Norge AS, 20 January.
131) Norwegian Petroleum Directorate (2016) *Rettelse til brev om samtykke til oppstart av Goliat FPSO med tilhørende produksjonsfasiliteter* (Norwegian only). Letter to Eni Norge AS, 21 January.
132) *Consent for start-up of Goliat.* <http://www.npd.no/en/news/News/2015/Consent-for-start-up-of-Goliat/> [16 August 2018].
133) Proposition to the Storting no. 64 (2008–2009) *Utbygging og drift av Goliatfeltet* (Norwegian only); see Innst. S. nr. 363 (2008–2009) *Innstilling fra energi- og miljøkomiteen om utbygging og drift av Goliat-feltet* (Norwegian only).
134) Proposition to the Storting no. 64 (2008–2009) *Utbygging og drift av Goliatfeltet* (Norwegian only); see Innst. S. nr. 363 (2008–2009) *Innstilling fra energi- og miljøkomiteen om utbygging og drift av Goliat-feltet* (Norwegian only).
135) Prop. 1 S (2016–2017) Ministry of Petroleum and Energy
136) *Lønnsomhetsberegninger for Goliat* (Norwegian only).. <https://www.regjeringen.no/no/aktuelt/lonnsomhetsberegninger-for-goliat/id2578892/> <https://www.regjeringen.no/no/aktuelt/lonnsomhetsberegninger-for-goliat/id2578892/> [16 August 2018].
137) E24, online edition 16 November 2017: *Goliat ble utsatt etter notat som spådde marginal lønnsomhet* (Norwegian only).
138) Verified minutes from meeting with Statoil, 12 March 2018.

Eni, Equinor, safety representatives and spokespeople at Goliat stated in interviews that they are all in agreement that it was appropriate to grant consent to commission the facility and to commence operations on Goliat in light of the knowledge they had at that time.[139, 140]

6.3 The PSA's supervision and use of sanctions

6.3.1 The PSA's supervisory practices on Goliat FPSO

Throughout 2017, the PSA conducted 24 supervisory activities concerning Eni's construction and operation of the Goliat platform. Of these, 18 were conducted in the planning, construction and completion phases, while 6 were conducted after the platform entered into operation. Table 9 lists the topics of supervision and the number of nonconformities and improvement points for each supervisory activity.

Table 9 Supervision, number of nonconformities and number of improvement points on Goliat FPSO, 2010–2017

Year	Topic	Nonconformitie	Improvement points	Total
2017	Barriers, electrical	3	4	7
2017	Risk management — follow-up of safety instrumented systems	1	1	2
2017	Risk management — work on hydrocarbon systems	1	4	5
2016	Working environment, employee participation	4	2	6
2016	Environmental data	0	0	0
2016	Logistics, employee participation	8	1	9
2015	Electrical	9	8	17
2015	Barriers — technical and operational	1	0	1
2015	Structural integrity, maritime systems	0	4	4
2015	Logistics	6	5	11
2014	Emergency preparedness, management	0	6	6
2014	Barriers — technical and operational	0	10	10
2014	Logistics	2	5	7
2014	Working environment, employee participation	0	2	2
2013	Barriers — technical and operational	1	0	1
2013	Preparation for operations	0	3	3
Total	**24**	**54**	**80**	**134**

Source: Petroleum Safety Authority's audit reports

The PSA paid particular attention to certain areas that they followed up over time. Barriers were the topic of seven supervisory activities, and six of these were conducted

139) Verified minutes from meeting with Statoil, 12 March 2018.
140) Verified minutes from meeting with Eni Norge AS, 13 March 2018.

before Eni received consent to begin operations. Six supervisory activities were carried out in the area of logistics, including crane and lifting operations. All supervision of logistics was carried out before Eni was granted consent. Then comes working environment with five supervisory activities, and employee participation with three..

6.3.2 Method of supervision

The supervision of Eni conducted in the conceptual and construction phase was on the level of systems and planning, but the PSA was also present at the shipyard and conducted supervision of the platform during construction. The supervisory activities were related to whether the facility would fulfil the requirements of Norwegian regulations when it arrived on the Norwegian continental shelf. The PSA stated in an interview that they gained a good overview of the development of the project by being an observer in the licence group. The PSA normally only participates in meetings with the licensees in certain selected licence applications, but in the development of the Goliat oil field the PSA had been in the licence group since the beginning.[141]

En gjennomgang av tilsynsrapportene fra Goliat FPSO viser at de tidlige tilsynene (2010–2012) i hovedsak var rettet mot designløsninger og planer. Petroleumstilsynet gjorde i mindre grad verifikasjoner i disse tilsynene, ettersom plattformen ikke var påbegynt. Tilsynene ble gjennomført med dokumentasjonsgjennomgang, presentasjoner og intervjuer med Eni og leverandørene.

A review of the audit reports from Goliat FPSO shows that the early supervisory activities (2010–2012) were primarily directed towards design solutions and plans. The PSA conducted fewer verifications in these supervisory activities, because construction of the platform had not yet begun. The supervision was carried out through document reviews, presentations and interviews with Eni and suppliers. After the early phase, the PSA conducted 17 supervisory activities from the manufacturing phase to the commencement of operations. In 11 of these, the PSA followed up the document review and interviews with verifications on the platform or in the shipyard. The PSA also conducted interviews with Eni's management and safety officers/spokespeople in the shipyard. The PSA identified an average of three nonconformities per supervisory activity when it conducted verifications, and 0.5 nonconformities in supervisory activities in which it did not conduct verifications.

Two of the trade unions represented on Goliat believe that the supervision was done well, and that it helped to identify real HSE challenges. The PSA always invites government contacts to participate in supervision, which the trade unions see as unproblematic. The government contacts do not participate in conversations with safety officers/spokespeople so that they can speak freely about any challenges to employee participation. Eni views the PSA's supervision as generally professional and competent, but notes that in some cases it can be difficult to understand the basis for nonconformities that the PSA identifies, because Eni does not have access to all the information the PSA bases the nonconformities on, for example interviews with the safety officers.[142,143]

141) Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.
142) Verified minutes from meeting with Eni Norge AS, 13 March 2018.
143) Verified minutes from meeting with Norwegian Oil and Gas, 7 February 2018.

6.3.3 Follow-up of findings

Eni believes that the PSA does a good job of following up on the supervision of Goliat. This is especially true for the topics the PSA has followed for a long time, such as logistics, electrical and employee participation.[144]

Fact box

World's northernmost oil platform

- The Goliat platform is the world's most advanced circular oil platform.
- It weighs 64,000 tonnes, and are 70 meters tall and 107 meters wide.
- It has 120 cabins and beds for 140.
- Underwater there are 8 templates with 22 wells.
- It has 14 anchor lines, in the world's strongest rope (90 cm), the longest is 1,250 m.
- Goliat gets electricity from land. The cable is 106 km long, 16 cm in diameter.
- It is specially constructed to withstand the rough weather conditions.

Source: Eni Norge

The trade unions are generally satisfied with how the PSA follows up findings from its supervision. One of the trade unions notes that nonconformities are taken seriously, and that Eni makes it a priority to rectify regulatory breaches. It can, however, be challenging to follow up nonconformities with subcontractors because the PSA's supervision is conducted with the operator companies. The other trade union believes that the PSA occasionally spends too much time following up findings with new supervisory activities. The trade union finds it surprising that it sometimes takes a long time before the PSA carries out supervision or follows up a facility after a problem has been discovered. They are also puzzled by the fact that the authority can identify the same problem for the second time and note it as a new nonconformity or improvement point, rather than escalating to a stronger response.

The PSA noted in several supervisory activities that Eni had not rectified nonconformities identified in previous supervision. In addition, the PSA has found nonconformities concerning the same topics of supervision over time, and although these nonconformities are not the same each time, they signify that Eni has faced continuing challenges with certain parts of the organisation and with equipment and the execution of work on the platform. Eni states that this is partially due to the fact that Goliat was a large and technically difficult project, and that the organisation was not prepared to handle the project's complexity. Frequent changes in directors and project managers and the large increase in tasks contributed to the challenges.[145] In addition, the PSA discovered nonconformities within several areas with each supervisory activity. In particular, there were many repeated nonconformities connected with the topics of

- barriers and electrical
- logistics
- employee participation

144) Verified minutes from meeting with Eni Norge AS, 13 March 2018.
145) Verified minutes from meeting with Eni Norge AS, 13 March 2018.

Barriers and electrical

The PSA paid a great deal of attention to barriers in the Goliat project. Part of this topic deals with ignition sources. Ignition sources are electrical and non-electrical sources of ignition on board the platform. If a gas leak were to occur, it is crucial that there be no equipment on board that could produce sparks and ignite the gas, thereby causing a major accident. Ignition source control has long been a challenge for Goliat, especially in connection with the electrical facility and Ex equipment.

In supervision of the electrical facility on Goliat in September 2017, the PSA noted nonconformities in Eni's management and risk analysis in connection with ignition source control, and improvement points in their system for prioritising repairs of Ex equipment.[146] he PSA had previously found deficiencies in Eni's work with ignition sources and Ex equipment through previous supervision in 2015,[147,148], 2014[149], 2013[150] og 2012[151]. Eni states that the PSA carefully followed up on the electrical area through supervision in autumn 2015, and that they continued to follow up on this in the years 2016–2018. Eni feels that the PSA has been thorough in its review of the electrical area.[152]

Logistic

The PSA carried out several supervisory activities concerning logistics (including crane and lifting operations and material handling) on Goliat, both in the shipyard in South Korea in 2012 and 2014[153,154], and in June 2015[155] after Goliat was placed in the field and the cranes were in use. All of these supervisory activities identified nonconformities and improvement points. In its audit of Goliat in June 2015, the PSA discovered that several of the same nonconformities and improvement points that had been identified previously were still present. The PSA wrote the following in its audit report from January 2016:

> "Eni did not provide a complete response after the supervision in 2015, despite several reminders. Nor did Eni carry out several of the measures to improve conditions as noted in the previous supervisory activities."[156]

Employee participation

Employee participation has been a continuing challenge in the Goliat project. In supervision conducted in July 2014, the PSA identified as an improvement point that "facilitation of employee participation, user involvement and education in the completion phase could be improved".[157] In January 2016 the PSA carried out another supervision of employee participation and identified as a nonconformity the fact that employees were not to a sufficient extent systematically involved in activities connected to cranes and lifting.[158] In summer 2016 a report of concern was sent to

146) Petroleum Safety Authority (2017) *Rapport etter tilsyn med Eni Norge om elsikkerhet og ansvarshavende for de elektriske anleggene Goliat FPSO* (Norwegian only), 31 October.
147) Petroleum Safety Authority (2015) *Tilsyn med elektriske anlegg på Goliat FPSO* (Norwegian only), 11 September.
148) Petroleum Safety Authority (2015) *Tilsyn med forberedelse til drift innenfor logistikk Goliat FPSO* (Norwegian only), 18 June.
149) Petroleum Safety Authority (2014) *Audit of technical and operational barriers on Goliat FPSO*, 14 March.
150) Petroleum Safety Authority (2013) *Rapport etter tilsyn med tekniske og operasjonelle barrierer på Goliat FPSO* (Norwegian only), 11 June.
151) Petroleum Safety Authority (2012) *Tilsyn med tekniske og operasjonelle barrierer på Goliat FPSO* (Norwegian only), 25 April.
152) Verified minutes from meeting with Eni Norge AS, 13 March 2018.
153) Petroleum Safety Authority (2012) *Rapport etter tilsyn med design av Goliat — materialhåndtering og arbeidsmiljø* (Norwegian only), 20 April.
154) Petroleum Safety Authority (2014) *Rapport etter tilsyn med materialhåndtering Goliat* (Norwegian only), 14 February.
155) Petroleum Safety Authority (2015) *Tilsyn med forberedelse til drift innenfor logistikk Goliat FPSO* (Norwegian only), 18 June.
156) Petroleum Safety Authority (2017) *Audit report — management of the working environment and employee participation Goliat*, 6 January.
157) Petroleum Safety Authority (2014) *Rapport etter tilsyn med styring av arbeidsmiljø i ferdigstillelsesfasen av Goliat-prosjektet* (Norwegian only), 23 June.
158) Petroleum Safety Authority (2016) *Oppfølging av tilsyn innen logistikk, med tillegg av arbeidstakermedvirkning Goliat* (Norwegian only), 7 January.

the PSA noting poor employee participation on Goliat.[159] The PSA then carried out a new audit on the topic of employee participation.The PSA identified as a nonconformity that "facilitation of real employee participation through the working environment committee and the safety representative scheme is not sufficient".[160] Eni concedes that they have had difficulty ensuring employee participation is at the right level.[161]

6.3.4 The PSA's use of sanctions against Eni

The PSA issued Eni with five orders regarding conditions on Goliat FPSO.

Table 10 Orders to Eni regarding conditions on Goliat FPSO since the beginning

Date	Title	Background
05/10/2017	Order following supervision of barriers and electrical safety (ATEX)	Supervision
19/01/2017	Order — risk management, working environment and investigation follow-up	Supervision
19/01/2017	Order after the investigation of a personal injury (incident of 25/06/2016)	Incident
31/08/2016	Order following power outage and lack of emergency power (incident of 26/08/2016)	Incident
18/02/2016	Orders following audit of logistics and employee participation	Supervision

Source: Petroleum Safety Authority

Table 10 lists the dates, titles and reasons for the orders issued by the PSA regarding Goliat FPSO.

All orders were issued after the PSA granted consent to commission the facility. Two of the orders were issued following serious incidents, on 31 August 2016 when the platform lost its power supply from land and the emergency power source failed, and following a serious personal injury when an individual was hit in the head with a steel cable during a lifting operation, respectively. The personal injury was also investigated by the PSA.

The three other orders resulted from the PSA's supervision or investigations. Two of these were based on repeated regulatory breaches or on Eni's insufficient ability to rectify previously identified regulatory breaches. The first of these orders was issued on 18. 18 February 2016, following an audit of logistics and employee participation in January 2016. In this audit, the PSA found that conditions that had been identified in previous supervision had still not been addressed in a satisfactory manner by the company. Eni had not provided a complete response after the supervision in 2015, despite several reminders. In addition, the company had failed to implement several of the measures they had presented to the PSA, which were meant to correct problems that had been identified in the previous audits.[162]

On 19 January 2017 the PSA issued Eni with two orders. One was based on the investigation of a serious personal injury in June 2016 and required that Eni survey

159) Industri Energi (2016) *Bekymringsmelding angående ledelsen i Eni* (Norwegian only). Letter to the Petroleum Safety Authority, 13 June.
160 Petroleum Safety Authority (2017) *Audit report — management of the working environment and employee participation Goliat,* 6 January.
161) Verified minutes from meeting with Eni Norge AS, 13 March 2018.
162) Petroleum Safety Authority (2016) *Oppfølging av tilsyn innen logistikk, med tillegg av arbeidstakermedvirkning Goliat* (Norwegian only), 7 January.

all lifting equipment, identify measures and make a plan for implementing said measures.[163] The other was based on a number of audits within the topics of risk management and working environment and required that Eni *"reassess current plans, priorities and use of resources to ensure acceptable completion and operation of Goliat"*.[164]

In September 2017 production on Goliat FPSO was suspended in order for Eni to carry out planned completion and maintenance work in accordance with the reassessed plans following the order from January 2017. From 19–28 September, the PSA carried out an audit of barriers and electrical safety. The PSA issued Eni with two orders following the audit:

- One order required that Eni carry out a systematic survey of potential ignition sources connected to electric motors in Ex implementation and execute necessary measures to reduce the risk of ignition as much as possible. The order further specified that Eni was not permitted to resume production on Goliat until these activities had been carried out, and that they were to notify the PSA when the order had been complied with.[165] In its annual report for 2017, the PSA recorded this order as a suspension of operations.[166] After receiving notification from Eni that the activities had been carried out, the PSA conducted an audit on board the platform on 23–24 November to confirm that Eni had executed the necessary measures. There was also a meeting with Eni's management held on 6 December. Equinor was also called to this meeting to explain what measures they had taken to fulfil their see-to-it duty as a licensee. The PSA deemed the order to be fulfilled on 8 December 2017, and production at Goliat was resumed.[167]
- The other order required that Eni review its system for follow-up of nonconformities in ignition source control. Eni was also ordered to review the nonconformities that were registered as rectified but which in practice turned out not to have been rectified.[168]

It is relevant to view the orders in the context of the PSA's consent to commission Goliat, granted on 19 January 2016. Several regulatory nonconformities identified in the orders are breaches of conditions set for the PSA's consent.

In accordance with the instrument manual, the PSA must follow up the orders in an appropriate manner based on the severity of the grounds for the order and experience with the company. The follow-up can be conducted through supervision, meetings or the submission of plans for measures.[169] Of the five orders that were issued to Eni, two were followed up through supervisory activity. These were the order of 5 October 2017 and the order for risk management and working environment of 19 January 2017. The others were followed up through responses from Eni without the PSA having verified that relevant measures had been implemented.

163) Petroleum Safety Authority (2017) *Order after the investigation of a personal injury (incident of 25/06/2016)*. Letter to Eni Norge AS, 19. 19 January.
164) Petroleum Safety Authority (2017) *Order for Eni Norge*. Letter to Eni Norge AS, 11 January.
165) Petroleum Safety Authority (2017) *Order to Eni Norge — electrical safety and person in charge of electrical facilities*. Letter to Eni Norge AS, 6 October.
166) Petroleum Safety Authority (2018) Annual Report 2017.
167) *Eni can resume Goliat production.* <http://www.ptil.no/enforcement-notices/eni-can-resume-goliat-production-article13227-892.html> <http://www.ptil.no/enforcement-notices/eni-can-resume-goliat-production-article13227-892.html> [16 August 2018].
168) Petroleum Safety Authority (2017) *Pålegg etter tilsyn med Eni Norge om elsikkerhet og ansvarshavende for de elektriske anlegg* (Norwegian only). Letter to Eni Norge AS, 13 November.
169) Petroleum Safety Authority (2017) *Virkemiddelhåndbok — bruk av virkemidler i tilsynet med helse, miljø og sikkerhet, internal guidelines* (Norwegian only), last updated 1 May 2017.

6.4 Follow-up of incidents and reports of concern

6.4.1 The PSA's follow-up of incidents on Goliat FPSO

Since Goliat FPSO was installed on the field in May 2015, 57 reportable incidents occurred (as of 31/12/2017). Of these incidents, 34 occurred after the commencement of production on 12 March 2016.

Gas leaks are among the most common incidents, occurring ten times in the given period. There were also six personal injuries, one of which was serious. Production was shut down a total of seven times during the period due to gas leaks or false alarms, and there were 16 instances of full mobilisation of personnel.

Three incidents in the period were categorised as serious by the PSA:

- On 26 August 2016 the gas alarm sounded on Goliat and production was shut down. During the shutdown, the platform lost its power supply from land. The emergency generator was turned on, but due to a problem it was turned off again. The platform switched over to UPS (uninterrupted power supply), and because this has a limited working time, the decision was made to evacuate some of the personnel on board. Nobody was hurt in the incident, and there was no contamination of the natural environment. On 31 August 2016 the PSA issued Eni with an order to "identify and implement necessary measures following the incident of 26 August 2016 in order to achieve compliance with health, safety and environmental legislation".[170] The PSA did not verify whether Eni had implemented relevant measures. However, meetings were held with Eni after the incident, in which the PSA was briefed on what measures Eni implemented following the incident.
- In connection with a lifting operation on 26 June 2016, a worker was hit in the head with a steel cable. The worker was evacuated from the platform and received treatment at a hospital. The PSA investigated the incident and discovered several regulatory breaches, including lacking and deficient barriers that could have otherwise prevented the serious incident from occurring. According to the PSA, a number of underlying causes—technical, organisational and operational—contributed to the incident's occurrence.[171] The findings of the investigation led the PSA to issue Eni with an order to "Systematically identify and review all lifting equipment and winches used for material handling on board and assess measures for further use or possibly ceasing to use this equipment." [172] Eni was also ordered to make a plan for what measures to implement, and to notify the PSA when the order had been complied with.
- During a crane operation on 17 August 2015 the booms of the two cranes on board collided. The crane operator had parked one of the cranes in such a way that it would collide with the other crane over the container landing site. When the cranes collided, a spotlight became detached from the stationary crane. The spotlight weighed 24 kg and, in combination with the height from which it fell, it most likely would have caused serious injury or death if it had struck a member of staff. There were two individuals present in the area where the spotlight fell, but neither was struck or injured in the incident. The PSA did not investigate the incident.

6.4.2 The PSA's follow-up of reports of concern regarding Goliat FPSO

Since 2012 the PSA has registered eight cases of reports of concern regarding conditions on Goliat FPSO in its archive. Each case can include one or several reports

170) Petroleum Safety Authority (2016) *Eni Norge AS has been issued with an order following an incident at Goliat*. Letter to Eni Norge AS, 30 August.
171) Petroleum Safety Authority (2017) *Investigation report — Goliat FPSO — serious personal injury 250616*, 19 January.
172) Petroleum Safety Authority (2017) *Order after the investigation of a personal injury (incident of 25/06/2016)*. Letter to Eni Norge AS, 19 January.

of concern. The true number of reports of concern received by the authority is higher than what is stated in the electronic mail journal.

Table 11 Overview of cases of reports of concern regarding conditions on Goliat FPSO

Date	Title at case level	Number of reports
03/10/2017	Technical safety — electrical — impairment of barriers	1
14/06/2016	Management at Eni	1
26/02/2016	Cranes and lifting	1
22/02/2016	Lacking construction expertise at Eni	1
01/12/2015	Cranes and lifting	1
02/10/2015	Electro	8
09/09/2015	Working conditions on Goliat — travel time	1
14/03/2012	Air compressor and oil vapours	1
Total	**8 cases**	**15**

Source: Petroleum Safety Authority

In total, the PSA has received 15 unique reports of concern regarding Goliat FPSO; see Table 11. A review of these reports indicates that there is great variation in how well the case processing and follow-up is documented in the authority's archive system, ePhorte.

- In five of the eight cases, it is not stated in the archive system (ePhorte) whether the sender received confirmation that their report was received, or what the result was. There was one case that was forwarded from the Labour Inspection Authority, and the PSA is not able to respond to anonymous senders. In its response to the audit in October 2018, the PSA states that Planverktøy shows that three of the five cases (that lack documentation in ePhorte) were handled in accordance with internal instructions.[173]
- In three of the cases, it is not documented in ePhorte if the PSA obtained more information about the case or if they addressed the concern with Eni. Nor is it documented in these three cases how the PSA followed up on the case, or if they made use of any measures or sanctions. The PSA stated in its response to the audit that Planverktøyet shows that the cases were handled in accordance with internal instructions for the relevant points.

The case regarding electrical from 2 October 2015 contained eight unique reports of concern from various people and organisations regarding the electrical system on Goliat. The reports were received in the period from October 2015 to August 2017. Five of the reports of concern were received before the consent for operation was granted. The PSA followed up the reports by requesting documentation from the operator and through correspondence with the reporters. One of the reports is signed off with a note that the PSA will take the concerns about ignition sources and electrical safety into account when processing the application for consent. The PSA carried out an audit of the electrical systems on Goliat in September 2017. This is not documented

173) Petroleum Safety Authority (2018) *Våre kommentarer til utkast til rapport fra Riksrevisjonen, Appendix 2* (Norwegian only), letter with appendix, 16 October 2018.

in the authority's archive system (ePhorte), but in an interview with the PSA it emerged that the audit was partly based on the reports of concern that the authority had received.[174] Another report concerning electrical and ignition sources was received in October 2017. The report stated that Eni planned to resume production following the audit despite the objections of the safety service. The PSA then decided to orderEni to rectify the nonconformities identified by the audit before being permitted to resume production.

174) Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.

7 The Songa Endurance incident

7.1 Background

A serious well control incident occurred on 15 October 2016 in connection with production drilling at the drilling rig Songa Endurance on the Troll oil field. The well was set to be abandoned, and the aim of the operation was to secure the well by installing barriers to prevent the emission of gas and fluid from the well opening.[175] During the operation, large amounts of gas were released under extremely high pressure, and the well became out of control. The gas blowout caused equipment weighing 2–3 tonnes to be thrown several metres across the drill floor, and the column of liquid from the well reached all the way to the top of the derrick, about 50 metres above the drill floor.

The PSA considers this to be one of the most severe well control incidents on the Norwegian continental shelf since the incident on Snorre A in 2004. Nobody suffered physical injury during the incident but, under slightly different circumstances, it could have led to a major accident with the loss of several lives as well as substantial material damage and emissions into the natural environment.[176]

Fact box 2 The blowout on Snorre A in 2004

One of the most serious incidents in Norwegian oil history is the blowout on Snorre A in 2004. The incident began on the evening of Sunday, 28 November 2004. The crew lost control of the well, and an uncontrolled gas blowout occurred. Pure coincidence and favourable circumstances prevented this from becoming a major accident. In its investigation, the PSA stated that this could have quickly ended in tragedy, with loss of life, damage to the environment and significant loss of material assets. There were 216 people on board. The PSA's investigative report uncovered serious failures and deficiencies in all aspects of Statoil's planning and execution of the task.

Source: Petroleum Safety Authority

Songa Endurance is a mobile, semi-submersible drilling rig designed for drilling, completion, testing and maintenance of wells.[177] Songa Endurance is owned by the rig company Songa Offshore (Transocean from 2018) and has an 8-year contract with Equinor with the possibility for renewal up to a total of 20 years.

The Troll oil field is distinguished from other fields due to its high drilling activity, lower pressure and numerous other qualities that make it challenging to extract the oil. Gas is therefore injected into the reservoirs in order to increase the pressure and make it easier to extract the oil.[178] The PSA states that they have a great deal of experience with Equinor's drilling on the Troll field because the company has drilled many wells there, and because the field gets a lot of attention from the company's specialist environments. In 2018 there were three active drilling rigs on the field.[179]

175) Statoil (2017) *Well control incident Troll 31/2-G-4 B (Songa Endurance), investigative report*, 4 January.
176) Petroleum Safety Authority (2017) Report of the investigation of the well control incident in well 31/2-G-4 BY1H/BY2H on the Troll field with the Songa Endurance drilling unit, 21 February.
177) Statoil (2017) *Well control incident Troll 31/2-G-4 B (Songa Endurance)*. Investigative report, 4 January.
178) Verified minutes from meeting with Petroleum Safety Authority, weeks 47 and 48 of 2017.
179) Petroleum Safety Authority (2017) *Report of the investigation of the well control incident in well 31/2-G-4 BY1H/BY2H on the Troll field with the Songa Endurance drilling unit*, 21 February.

The well control incident on Songa Endurance in 2016 is an example of an incident that could have turned into a major accident with loss of human life. The incident is one of three well control incidents since 2004 to which the PSA has assigned the highest degree of severity, and it has several causes in common with previous serious incidents on the Norwegian continental shelf. The incident on Songa Endurance prompted comprehensive investigative reports from both Equinor and the PSA, with several serious findings and subsequent orders. The PSA also carried out a follow-up audit of Equinor and Songa Endurance after issuing the order.

The well control incident on the Songa Endurance drilling rig is one of the most serious to have ever occurred on the Norwegian continental shelf. Source: Transocean.

The Songa Endurance incident helps to illuminate how the PSA practices consent, investigations and supervision, and how it follows up orders issued in connection with serious incidents. The case study also helps to illuminate the PSA's use of sanctions against companies following serious incidents.

7.2 Consent to use Songa Endurance on the Troll gas field

Consent from the PSA can apply to several wells to be drilled by the same operator and rig in a field. In its application for consent, the operator Equinor therefore applied for consent to drill several wells using Songa Endurance.[180] On 17 December 2015 Equinor was granted consent to use Songa Endurance for production drilling, completion, well overhaul, intervention and plugging until 19 December 2023. The consent was granted in part based on documents sent by Equinor in connection with the application and documentation relating to the AoC for Songa Endurance.[181]

180) Verified minutes from meeting with Petroleum Safety Authority, weeks 47 and 48 of 2017.
181) Petroleum Safety Authority (2015) *Songa Endurance — Samtykke til bruk av Songa Endurance* (Norwegian only). Letter to Statoil, 17 December.

In the application for consent, Equinor stated that it intended to carry out permanent plugging of existing wells, overhauling and maintenance, and drilling and completion of new wellbores using Songa Endurance on the Troll field. It is stated that the operations planned on the Troll field are standard operations.[182] Equinor wrote that they felt it was realistic to say that they would be able to regain well control in the event of an imbalance in the well on the Troll field because they have a lot of experience on the field, good familiarity with the formations and a standardised and repeated method selection process.[183]

The PSA stated in an interview that the consent was for the use of Songa Endurance on the Troll field for several years, and not consent for a specific drilling or well operation.[184] Equinor specified in an interview that what was described as standard operations in the application for consent referred to the overall well operations, and not necessarily the specific method that was used at the time of the incident on Songa Endurance in November 2016. Equinor recognises that the method that was being used on the G-4 well at the time of the incident was not a standard operation.

Equinor also states that the training that took place prior to the incident was conducted in the company's usual manner, but that it was not sufficient for the type of well system represented by the G-4 well, nor for the specific type of well operation that was carried out on 15 October 2016. The crew was also not sufficiently knowledgeable about conditions specific to the Troll field. This is pointed out by both the PSA and Equinor in their investigations of the incident.[185]

7.3 What happened before, during and after the incident

7.3.1 The planning of the drilling operation

Part of the operation of plugging and abandoning the G-4 well consisted of removing the tubing hanger that was still connected to the wellhead. To do this, it was necessary to establish barriers that prevented gas and fluid from flowing out of the reservoir. Examples of such barriers are cement plugs, mechanical plugs or a combination of the two. Equinor's drilling organisation responsible for the Troll field prepared a concept selection report describing the choices of barriers prior to the removal of production tubing. This was signed on 11 May 2016. The concept selection report defined deep-set plugs as the primary barriers.[186] This is also the recommended primary barrier in Equinor's Troll Main Activity Programme for wells with valves and tubing of the type present on the G-4 well. The Troll Main Activity Programme was developed in order to standardise and improve plugging and abandonment operations on the Troll field.

The use of deep-set plugs is time-consuming, and to save costs and reduce the operation time by 12 hours, the plans for the operation were changed.[187] The change consisted of using a set of valves on the production tubing as a primary barrier (flow

182) Statoil (2015) *Vedlegg til søknad om samtykke til boring og komplettering med Songa Endurance på Troll* (Norwegian only). Letter to the Petroleum Safety Authority, 14 October.
183) Statoil (2015) *Vedlegg til søknad om samtykke til boring og komplettering med Songa Endurance på Troll* (Norwegian only). Letter to the Petroleum Safety Authority, 14 October.
184) Verified minutes from meeting with Petroleum Safety Authority, 18 June 2018.
185) Verified minutes from meeting with Statoil, 12 March 2018.
186) Petroleum Safety Authority (2017) *Report of the investigation of the well control incident in well 31/2-G-4 BY1H/BY2H on the Troll field with the Songa Endurance drilling unit*, 21 February.
187) According to the PSA's investigative report, it takes about 12 hours to instal a deep-set plug.

control valves (FCV) and gas lift valve (GLV)) instead of deep-set plugs.[188] In Equinor's investigation of the incident it appears that the final programme with the selected primary barriers was approved internally on 8 July 2016.[189] The PSA's investigation shows that the use of these valves as a barrier element was in opposition to both the plan outlined in the concept selection report and the recommendation of Equinor's Troll Main Activity Programme.[190]

The selection of FCV and GLV as barrier elements was made despite the fact that the approval for their use as primary barriers applied to wells with a different type of "Christmas tree" from the one on the G-4 well.[191] A Christmas tree is a configuration of valves and tubing that sits on the wellhead. The use of FCV and GLV was not identified as a risk in the planning and preparation for the operation. Nor was the fact that these valves could be opened during the pressure testing of the operation, thereby weakening or removing the primary barrier.[192] It is, however, stated in the Troll Main Activity Programme that every pressure test will impact the control lines of these valves.[193] Equinor stated in an interview that the risk analysis when selecting barriers was deficient, and that the supplier of the equipment installed on the well was therefore not involved in the planning process. This once again meant that equipment-specific expertise was lacking, both in the risk analysis and in the execution of the operation.[194]

On 15 February and 28 June 2016, Equinor conducted two internal meetings at which the main risks of plugging and abandoning the G-4 well were discussed. Representatives from the suppliers of key equipment components (GE VetcoGray — Christmas tree; and Baker Hughes — valves) were not invited to participate in these meetings.[195] Nor were the subcontractors' engineers who had installed the valves on the G-4 well in 2012 involved in the decision to use the valves for anything other than their intended purpose.[196]

The detailed plan for the pulling of the tubing hanger was completed on 12 October 2016. Further changes were made to the detailed plan on 14 October, the day before the incident. Under the original plan, the annular preventer was to be closed when the tubing hanger secondary retrieving tool was connected to the tubing hanger. However, the closing of the annular preventer was delayed, instead taking place during the pulling of the tubing hanger.[197] The annular preventer was therefore not closed because changes were made to the detailed operation procedure shortly before the operation began. The decision to make a significant change was made by engineers and the responsible drilling engineer from Equinor without involving the senior tool pusher on Songa Endurance.[198]

188) There are valves and tubing installed on the wellhead to control the flow of oil and gas from the reservoir. These can have various configurations, and the type of valve configuration installed on the wellhead is essential to choosing the proper barriers. The valve configuration is called a "Christmas tree" and comes in two variations: horizontal and vertical. Most of the wells on the Troll field have horizontal Christmas trees supplied by Aker Solutions ASA. A smaller number of wells, including the G-4 well, have vertical Christmas trees supplied by GE VetcoGray.
189) Statoil (2017) *Well control incident Troll 31/2-G-4 B (Songa Endurance). Investigative report*, 4 January.
190) Petroleum Safety Authority (2017) *Report of the investigation of the well control incident in well 31/2-G-4 BY1H/BY2H on the Troll field with the Songa Endurance drilling unit*, 21 February.
191) Statoil (2017) *Well control incident Troll 31/2-G-4 B (Songa Endurance)*. Investigative report, 4 January.
192) Statoil (2017) *Well control incident Troll 31/2-G-4 B (Songa Endurance)*. Investigative report, 4 January.
193) Petroleum Safety Authority (2017) *Report of the investigation of the well control incident in well 31/2-G-4 BY1H/BY2H on the Troll field with the Songa Endurance drilling unit*, 21 February.
194) Verified minutes from meeting with Statoil, 12 March 2018.
195) Petroleum Safety Authority (2017) *Report of the investigation of the well control incident in well 31/2-G-4 BY1H/BY2H on the Troll field with the Songa Endurance drilling unit*, 21 February 2017
196) Statoil (2017) *Well control incident Troll 31/2-G-4 B (Songa Endurance)*. Investigative report, 4 January.
197) Petroleum Safety Authority (2017) *Report of the investigation of the well control incident in well 31/2-G-4 BY1H/BY2H on the Troll field with the Songa Endurance drilling unit*, 21 February.
198) Statoil (2017) *Well control incident Troll 31/2-G-4 B (Songa Endurance)*. Investigative report, 4 January.

Songa Offshore stated in an interview that the company felt there were a number of holes in the planning of the well operation. This includes the lack of involvement of relevant expertise from both Equinor and the equipment suppliers. Songa Offshore did not feel that there was anything abnormal about the drilling programme when they received it. The company also does not feel it is realistic to expect them to have been able to recognise the risks associated with the drilling programme at that time. Songa Offshore believes that the procedures for making changes to the drilling programme prior to the drilling operation were not well designed, and that the investigation they conducted in collaboration Equinor also confirmed this. However, they state that it is not unusual for changes to be made to the drilling programme. Songa introduced third-party verification of drilling plans from the operator as a quality assurance scheme following the incident. [199]

Songa Offshore stated in an interview that there was a great deal of pressure to be efficient on the Troll field. According to Songa Offshore, a long period without incidents contributed to the development of an attitude on Equinor's part that drilling on the Troll field was easy.

The pressure in the reservoir was low and therefore entailed relatively little risk in drilling and well operations. Under such circumstances it is easy to make changes without properly analysing the risks, according to Songa Offshore. Equinor stated in an interview that they agree that there is a lot of pressure in the drilling organisation and that they have implemented improvement programmes to reduce costs. Nevertheless, they do not believe that this contributed to the incident. The Troll organisation in particular has been under a lot of pressure, but not in a way that compromises safety, according to Equinor.

Drilling and well operations are costly and represent a large portion of the costs for activities on the Norwegian continental shelf. Over time there has therefore been a strong focus on reducing costs connected to such operations.[200] It is also a well-known fact that key decision-makers may face conflicting objectives between efficiency and cost reduction on the one hand and safety on the other. This was one of the contributing factors in the Deepwater Horizon incident in the Gulf of Mexico in 2010 and the Snorre A blowout in 2004.[201] The PSA's investigation claims that in the Troll drilling organisation there was a similarly strong focus on reducing costs and operating efficiently. The drilling programme was changed in order to save 12 hours. No risk analysis was conducted for the change in plans. The trade unions claimed in an interview that a great deal of importance was placed on efficiency, simplification and cost-cutting at the time of the Songa Endurance incident. According to one trade union, nobody asked questions internally at Equinor when a barrier had been removed prior to the incident, and the union points out that similar incidents, in which barriers are removed without anyone questioning it, have happened before.

In an interview with the trade unions it also emerged that the operation that led to the Songa Endurance incident was not adapted to the well. According to one of the trade unions, the responsible members of the Troll drilling organisation had copied a programme from a previous well on the field. When a programme is copied from another well, there is a risk that old errors will be transferred and that new errors will be created because the programme is not adapted for the well on which the operation will be carried out, according to the trade union. One trade union also stated that the majority of errors generated in such operations originate in the planning phase conducted on land, and not the employees working out on the rig.

199) Verified minutes from meeting with Songa Offshore, 13 March 2018.
200) Ministry of Petroleum and Energy (2012) *Økt bore- og brønnaktivitet på norsk sokkel* (Norwegian only).
201) Sintef (2011) *Deepwater Horizon-ulykken: årsaker, lærepunkter og forbedringstiltak for norsk sokkel* (Norwegian only).

7.3.2 The well control incident

The outflow of gas happened at 09:33 on 15 October 2016. Large quantities of fluid and gas flowed out of control up through the drill floor, and sea water was pushed more than 50 metres up the derrick. Activation of a number of gas detectors led to local equipment shutdowns on board the rig. The well was shut with the annular preventer in the blowout preventer (BOP) after approximately one minute.[202] Then the blind shear ram, which was the next barrier, was activated. It was subsequently found that the blind shear ram did not function as intended. The well was first stabilised 11 days after the incident occurred.

Songa Offshore stated in an interview that the activation of the BOP by the crew on board the rig prevented a major accident. [203] If they had delayed their reaction, the incident could have had a completely different outcome. In the time it took to close the annular preventer (35 seconds), water and gas flowed onto the deck. If the BOP had not been activated, more gas could have come onto the deck and reached a dangerous concentration, and it might not have been possible to stop the flow from the well. Songa Offshore believes that we have never been closer to an accident of this type since the Snorre A incident in 2004.

Equinor notified the PSA three hours after the incident occurred, at 12:30, and the duty emergency response officer mobilised resources to follow up Equinor's work on safeguarding personnel and dealing with the loss of well control. According to Equinor, the PSA followed up the incident closely and had daily meetings with the company during the normalisation process.[204] Equinor stated in an interview that the emergency preparedness procedures on Songa Endurance worked well during the incident. The crew on board the rig did what they were supposed to do and reacted correctly and quickly. Both Equinor and the PSA's investigations concluded that the rig personnel handled the situation well and that this helped to limit the consequences of the incident. According to Equinor, this indicates that the personnel on board the rig had received sufficient education and training in emergency preparedness.[205]

On 16 October 2016 a kill operation was initiated to balance the pressure in the well, but the well was first stabilised ten days later after a long and challenging period of normalisation work.

7.4 Equinor's investigation of the incident

Due to the scope of the gas leak during the incident and the financial consequences of the shutdown and normalisation period, Equinor classified the incident with the highest degree of severity. Equinor's investigation states that the incident had resulted in a total cost of approximately 132 MNOK at the time of the investigation.[206] In connection with the release of its investigative report, Equinor stated that the incident is one of the most serious well control incidents in the company's history.[207]

202) The BOP is a large, specialised valve or mechanical device installed on the wellhead. It is designed to close and control oil and gas wells and to prevent uncontrolled discharges of oil or natural gas.
203) Verified minutes from meeting with Songa Offshore, 13 March 2018.
204) Verified minutes from meeting with Statoil, 12 March 2018.
205) Verified minutes from meeting with Statoil, 12 March 2018.
206) Statoil (2017) *Well control incident Troll 31/2-G-4 B (Songa Endurance)*. Investigative report, 4 January.
207) *Investigations of serious incidents completed*. <https://www.Statoil.com/no/news/press-meeting-friday-20-january.html> [27 August 2018].

Table 12 Direct and underlying causes of the incident on Songa Endurance

Direct causes	Underlying causes	Overarching underlying causes
The decision to use valves that could be opened a deep-set plug as primary barriers	- Stronger focus on cost. - Confirmation bias among unintentionally, instead of personnel on Troll. - Lack of i nvolvement of	- Insufficient change management, lack of risk analysis and lack of quality control. - Lack of understanding of the Vetco wellhead system.
The valves were opened	- Failure to identify the risk of the valves being opened unintentionally. - Information from the Troll Main Activity Programme was not utilised.	

Source: Equinor's investigative report

Table 12 shows direct and underlying causes of the incident identified in Equinor's investigative report. The investigative report states that insufficient change management, lack of risk analysis and lack of quality control are the underlying causes of the well control incident. The investigative report also notes that the use of the selected primary barriers can be linked to a stronger focus on cost and increased importance of efficiency in well operations on the Troll field; see Table 12. According to the report, the 2014 drop in oil prices may have contributed to the approval of the suggestion to consider these barriers. The report specifies, however, that Troll has always had a culture of optimisation, and that the idea to use the well barriers in question originated before the oil price fell in 2014.

The investigative report also notes that the decision to use the primary barriers in question could be blamed on a confirmation bias in Equinor's drilling organisation with responsibility for the Troll field. Information that did not support the employees' hypotheses was given less weight, and the challenges involved with the use of these barriers on the well were reviewed and investigated insufficiently. It is also noted that it was unfortunate that the subcontractors who were familiar with the chosen primary barriers were not involved in the planning of the operation. Nor were various disciplines and professionals brought together to discuss the risks associated with the change of primary barriers. The risk of the valves opening was not identified through the risk meetings or through quality control. Available information about well conditions was not utilised by the project team. Several of Equinor's internal requirements concerning the use of inlet valves were not taken into consideration. The investigative report emphasises that every operation or situation must be safeguarded against the potential failure of one of the barrier elements. This was not the case with the operation that led to the well control incident.

7.5 The PSA's investigation of the Songa Endurance incident

In its investigative report, the PSA wrote that the incident was one of the most serious well control incidents to occur on the Norwegian continental shelf since 2004, and that under slightly different circumstances, it could have led to a major accident with the loss of several lives as well as substantial material damage and emissions into the natural environment.[208]

208) Petroleum Safety Authority (2017) *Report of the investigation of the well control incident in well 31/2-G-4 BY1H/BY2H on the Troll field with the Songa Endurance drilling unit*, 21 February.

The PSA received Equinor's investigative report on 20 January 2017. In its own investigation, the PSA found Equinor's report to be thorough and well organised, but stated in an interview that the report does little to explain why there were so many breaches of Equinor's governing documents, and why the company's management failed to ensure that procedures were upheld. The authority also believes that the report did not give enough consideration to the reliability of gas detectors when there are large amounts of water particles in the air, and that there is a danger that the risk of ignition could mistakenly be underestimated if the readings do not reflect the actual situation. Equinor's report also did not evaluate what ignition sources and other potential for damage there would have been if the annular preventer had been closed at a later point in time.[209] The PSA also stated in an interview that there is a high degree of correlation between their investigative report and Equinor's.[210]

According to the PSA's investigative report, the underlying causes of the uncontrolled flow from the well can be linked to
- insufficient planning and understanding of risks
- insufficient management of change
- lack of relevant expertise

Corresponding conditions have been identified as underlying causes by the PSA following several other serious incidents on facilities for which Equinor was the operator, for instance the well control incidents on Snorre A (2004) and Gullfaks C (2010), and the gas blowouts at Gullfaks B (2010) and Heimdal (2012). A summary of the incidents' underlying causes is given in Appendix 2. Insufficient planning and understanding of risks was an underlying cause in all the aforementioned incidents; according to the PSA's investigations, insufficient management of change contributed to the incidents on Snorre A, Gullfaks B and Heimdal, while insufficient expertise was a key factor in the incidents on Gullfaks C, Gullfaks B and Heimdal. However, the PSA stated in an interview that these underlying causes are typical with well control incidents, and that an investigation following an incident will always find faults, and often within one or several of these areas.[211]

The PSA's investigative report following the incident on Songa Endurance, which was published on 21 February 2017, identified serious regulatory breaches within several areas:
- compliance with procedures
- design of well barriers
- risk analysis as a decision-making basis when streamlining operations
- competence
- execution of flow checks

The PSA states that the identified nonconformities largely coincide with nonconformities identified following their investigations of the well control incidents on Snorre A in 2004 and Gullfaks C in 2010.[212] The nonconformities also largely coincide with nonconformities identified in the investigations of serious incidents on Gullfaks B in 2010 and Heimdal in 2012; see Appendix 3.

209) Petroleum Safety Authority (2017) *Report of the investigation of the well control incident in well 31/2-G-4 BY1H/BY2H on the Troll field with the Songa Endurance drilling unit*, 21 February.
210) Verified minutes from meeting with Petroleum Safety Authority, 18 June 2018.
211) Petroleum Safety Authority (2018) *Skriftlig svar på spørsmål fra sluttintervju* (Norwegian only). Email to the Office of the Auditor General, 18 June.
212) Petroleum Safety Authority (2017) *Report of the investigation of the well control incident in well 31/2-G-4 BY1H/BY2H on the Troll field with drilling unit Songa Endurance on 15 October 2016 and issue of an order*. Letter to Statoil, 21 February.

The PSA noted in an interview that Equinor has implemented comprehensive and lengthy improvement measures to comply with previous orders, but that these do not appear to have had a sufficient effect in all aspects of the company. Based on the findings of the investigation, the authority therefore issued Equinor with an order to to have had a sufficient effect in all aspects of the company. Based on the findings of the investigation, the authority therefore issued Equinor with an order to

- identify the reasons why the improvement measures that Equinor implemented after the aforementioned incidents, and which are relevant to the conditions identified following this incident, did not have the necessary effect on the Troll drilling organisation
- present a plan to ensure that necessary improvement measures are implemented and have an effect on the Troll drilling organisation

In Equinor's response to the order following the Songa Endurance incident, the company described various reasons why knowledge gained from previous incidents (such as the incidents on Snorre A and Gullfaks C) did not have an effect on the Troll drilling organisation, and various improvement measures the company has established.[213] The main reasons, according to Equinor, were linked to leadership, competence and the management system. Equinor also stated that the company has established several improvement measures aimed at the main causes of the incident. These include increased leadership involvement, increased awareness of risk associated with well control and well barriers, an equipment course for the Troll drilling organisation about Vetco wellheads and valve trees, and an update of the processes that govern changes in drilling plans.

Equinor stated in in an interview that they found the PSA's investigative report to be accurate and good, and that in their opinion it includes concrete and specific findings, which simplifies their task of implementing appropriate measures.[214] However, according to Equinor it was difficult to identify specific measures following the two orders that were issued after the investigation, because they were formulated in such a general way. Nevertheless, the company felt that the orders contained natural and appropriate questions and demands.[215]

The PSA stated in an interview that they often go into underlying causes in greater depth than Equinor.[216] The PSA has experience with the causes of incidents often going all the way to management level. For example, Equinor's management was criticised in the investigation of Heimdal in 2012. The PSA also states that it is difficult to conclude on a general basis whether Equinor's organisation has the ability to learn from previous serious incidents. The authority additionally believes that it is difficult to draw conclusions regarding the reasons for deficiencies in this area of Equinor's organisation. The PSA notes that Equinor implemented a number of measures following the Snorre A incident, but that nevertheless the authority identified similar conditions on Gullfaks C six years later. The authority could therefore determine that the measures had not had enough of an impact to prevent later incidents.

The PSA believes that Equinor follows up all orders with necessary measures, and that incidents with the same causes do not constitute grounds to claim that Equinor has not followed up previous orders, only that they have failed in those specific instances. The PSA concludes that Equinor has shown that they have the ability to learn from all of these incidents, but that the causes are complex, and that in these specific instances

213) Statoil (2017) *Svar på pålegg etter granskingsrapport av brønnkontrollhendelse i brønn 31/2-G-4 BY1H\BY2H på Trollfeltet med boreinnretningen Songa Endurance den 15.10.2016* (Norwegian only). Letter to the Petroleum Safety Authority, undated.
214) Verified minutes from meeting with Statoil, 12 March 2018.
215) Verified minutes from meeting with Statoil, 12 March 2018.
216) Verified minutes from meeting with Petroleum Safety Authority, 18 June 2018.

Equinor nevertheless failed to prevent new incidents from occurring. Very many well operations are carried out, the vast majority of them without incident. The PSA also points out that there was a positive development in well control incidents in the period 2004–2017.

7.6 The PSA's follow-up to the investigation of the Songa Endurance incident

On 26 June 2017 the PSA announced a follow-up audit of Equinor and Songa Endurance oriented towards the planning and execution of drilling operations on the Troll field. The aim was to confirm that Equinor and Songa Offshore were in compliance with regulations regarding planning, risk analysis and execution of drilling and well operations. The audit was conducted in the period 6–21 September 2017, and the report was published on 13 November 2017.

In the audit report, the PSA identified four nonconformities and two improvement points.[217] The authority observes that there is greater awareness of well control in Troll's drilling and well organisation, but at the same time there is a strong focus on increasing efficiency and reducing costs. The authority notes that through the audit, concerns arose that this situation could compromise safety. They also identified the following regulatory nonconformities:

- lack of documentation of the claim that the limitations set for the drilling of wells a short distance from adjacent wells (intersecting wellbores) are sufficient
- lack of risk analyses that provide a nuanced and holistic picture of the risks associated with drilling and well activities on the Troll field
- insufficient ability and expertise among professionals in Troll's drilling and well department
- insufficient education of, training and exercises for third-party personnel to ensure safe operation and the workers' roles as operational and organisational barrier elements

According to the PSA, the audit of autumn 2017 was conducted to investigate whether Equinor had learned from the incident in 2016 and followed up the order that was issued.[218] This time the PSA conducted a verification out on the rig. The authority's impression is that there is now greater awareness of well control throughout Troll's drilling organisation, both on land and offshore, and that this is the result of experience and knowledge gained from the incident on Songa Endurance in autumn 2016. Equinor's drilling management also responded that several of the conditions identified by the investigation had been addressed.

At the same time, according the authority, Equinor has gone from four to three rigs on the field by streamlining its activities. This means that each rig must drill faster. As the PSA sees it, there is no prohibition against efficiency, but safety must also be preserved. It is not the case that everything is perfect in Equinor's handling of drilling operations on the Troll field. A number of conditions were pointed out to Equinor that must be addressed. Equinor is therefore expected to take care of this before the authority is satisfied with drilling operations on the Troll field. In a letter dated 15 January 2018, Statoil and Songa Offshore explained their handling of nonconformities and improvement points from the audit report. [219] In the letter, Equinor recognised that

217) Petroleum Safety Authority (2017) *Tilsynet med Statoil og Songa Offshores planlegging og gjennomføring av bore/brønnoperasjoner på Troll* (Norwegian only), 13 November.
218) Verified minutes from meeting with Petroleum Safety Authority, weeks 47 and 48 of 2017.
219) Songa Offshore/Statoil (2018) *Tilbakemelding på tilsynsrapport — Statoil og Songa Offshore sin planlegging og gjennomføring av bore-/brønnoperasjoner på Troll* (Norwegian only). Letter to the Petroleum Safety Authority, 15 January.

the comprehensive picture of risks facing the Troll field could have been better explained. Equinor also recognises that the specified concept of risk is not fully communicated and implemented in the organisation, and the company is working to standardise and clarify the way in which risk analysis is carried out for well planning on the Troll field. Equinor is also working to look into the possibility of adding extra personnel with Troll expertise, as the workload for 2017 was high. The letter was followed up with a meeting between the PSA and Equinor on 14 March 2018. The topic was how the chosen solutions and methods used on the Troll field are as safe as or safer than the solutions described in guidelines and standards. Prior to the meeting, Equinor sent a risk analysis. The PSA stated in an interview that they feel that probability and thereby risk are given very little weight in the risk analysis. Various scenarios are not viewed and assessed in context, and uncertainty is not discussed or assessed in the risk analysis. Equinor stated in an interview that it can be challenging to understand what specific measures the PSA believes the company should implement, and commented that nonconformities and orders can be formulated in quite general terms. It can therefore in certain cases be unclear to Equinor what the authority expects of the company following supervision, investigations and orders.

7.7 The PSA's follow-up of orders issued following previous serious incidents on Gullfaks and Heimdal

After several serious incidents where Equinor was the operator, the PSA issued orders and wrote a letter to the company's management; see Fact box 3. According to the PSA, an order is a strong preventative tool that is legally binding for the recipient.

Fact box 3 Overview of orders issued by the PSA following serious incidents where Equinor was the operator

- Snorre A 2004:
  - prepare a binding and time-delimited plan for activities that can identify the reasons for the nonconformities identified in the report
  - carry out the activities in accordance with the stated plan

- Gullfaks C 2010:
  - carry out an independent assessment of how measures implemented following previous incidents, including the gas blowout on Snorre A in 2004 with similar causes, did not have the desired effect on Gullfaks
  - implement measures and a binding plan to be sent to the PSA

- Gullfaks B 2010:
  - No orders were issued, but because the causes of the incidents shared common traits with the causes of the Gullfaks C incident in 2010, the PSA chose to send an open letter to Equinor's executive vice president responsible for the Norwegian continental shelf. The authority's investigative report showed that the incident shared common traits with the incidents on Snorre A in 2004, Statfjord A in 2008 and Gullfaks C in 2010.

- Heimdal 2012:
  - identify the reasons why the improvement measures implemented by Equinor did not have the necessary effect on Heimdal
  - ensure that the aforementioned improvement measures have the necessary effect on Heimdal
  - present a plan for the work necessary to achieve this

Following the incident on Gullfaks C and the incident on Heimdal in 2012, the PSA imposed orders referring to the fact that previously implemented measures had not had the desired effect. This was also done after the Songa Endurance incident.

7.7.1 Follow-up of orders issued after the incidents on the Gullfaks oil field in 2010

In 2010 two serious incidents occurred on the Gullfaks oil field: a serious well control incident on Gullfaks C on 19 May 2010 and a serious gas leak on the Gullfaks B platform on 4 December 2010. In its audit report following the incident on Gullfaks C the PSA identified serious deficiencies and a number of regulatory breaches in Equinor's planning of drilling operations on the well. [220] The audit report notes several challenges for Equinor regarding the follow-up of incidents and gaining knowledge from them. The challenges were applicable to the entire Norwegian continental shelf and corresponded with what the PSA observed in its follow-up of serious incidents on Snorre A in 2004 and Statfjord A in 2008 and in connection with the company's cuttings injections in the period 2007–2010.[221] They pointed out that involvement of necessary professionals in planning and risk analysis was still a challenge, despite the order to strengthen these efforts following the Snorre A incident in 2004. The order was issued to the company on 6 December 2010; see Fact box 3.

On 23 July 2012 the PSA determined that the order following the Gullfaks C incident had been fulfilled.[222] The order that was issued following the Gullfaks C incident is not limited in its scope to that platform, but applies to the Gullfaks field in general. When the PSA views the order as fulfilled, it can therefore be understood to encompass both incidents in 2010. The assessment of the order as fulfilled was based on meetings with Statoil in which the company presented its improvement efforts. The PSA states on its website that comprehensive measures have been implemented and much important work has been undertaken by the company to prevent similar incidents from happening again. Based on the plans and measures presented by the company, the PSA chose to view the order as fulfilled.

Twelve supervisory activities (audits/verifications) were carried out on the Gullfaks field in the period 2013–2017. Three of these had drilling and well technology as their subject (2013, 2015, 2016). In 2015 the PSA discovered serious deficiencies in Equinor's drilling and well operations on Gullfaks C.[223] The supervision was conducted with verifications offshore and on land. They identified several regulatory nonconformities and safety-related deficiencies in Equinor's drilling and well operations on the Gullfaks C platform, such as insufficient management of risks in drilling facilities and failure to control the condition and maintenance of known deficiencies in safety-critical equipment. They also noted as an improvement point that Statoil had done little to implement measures to reduce the negative consequences to HSE of cost-cutting and the pressure for efficiency. Based on this supervision, Equinor was issued with an order to obtain a general and updated overview of the BOP control system and to present a time-delimited and binding plan for rectifying the deficiencies.[224]

220) Petroleum Safety Authority (2010) *Audit of Statoil's planning for well 34/10-C-06A*, no date.
221) The incident on Statfjord A was a hydrocarbon leak with potential to cause a major accident. The incident was investigated by the PSA. Challenges with leaks from injection wells were identified by the PSA in 2010. This was partly based on the fact that they discovered several incidents involving leakage of drill cuttings and fluid to the seabed from injection wells.
222) *Gullfaks C order fulfilled.* <http://www.psa.no/news/gullfaks-c-order-fulfilled-article8675-878.html> [16 August 2018].
223) Petroleum Safety Authority (2016) *Rapport etter tilsyn med rammebetingelser i boring og brønn* (Norwegian only), audit report, 4 June.
224) *The PSA has issued an order to Statoil following audits at Oseberg B and Gullfaks C,* http://www.ptil.no/enforcement-notices/order-for-statoil-following-drilling-and-well-investigation-article11443-892.html http://www.ptil.no/enforcement-notices/order-for-statoil-following-drilling-and-well-investigation-article11443-892.html [29 August. 2018].

7.7.2 Follow-up of orders issued after the Heimdal incident in 2012

On 26 May 2012 a serious gas leak occurred on the Heimdal platform. The leak was one of the largest and most serious to occur on the Norwegian continental shelf in several years, and had significant potential for a major accident. The PSA's investigative report of 20 December 2012 showed that key measures for improvement identified and implemented by Equinor after previous incidents, such as the Gullfaks B incident in 2010, had not had the expected effect on the Heimdal oil field.[225] Orders were issued on 24 January 2013 to identify reasons for why previous measures for improvement had not been effective, and to ensure that they would now be effective; see fact box 3.

The PSA determined the order to be fulfilled in a letter to Equinor on 21 May 2013.[226] The PSA wrote in the letter that orders issued following the Heimdal incident are viewed as closed based on information from Statoil that improvement measures have been effective throughout the organisation. At the same time, the PSA requested a follow-up meeting at the end of 2013 to be briefed on the effects of the measures. On 29 November 2013 Equinor presented its assessment of the effects of the implemented measures in a meeting with the PSA. According to Equinor's minutes from the meeting, it appears that the PSA took note of the information that was presented, and that the authority would notify Equinor of any further follow-up.[227]

In a statement to Rogaland Police District on 15 January 2014 the authority noted that the serious regulatory breaches identified in its investigative report could qualify for corporate penalties in accordance with Section 48c of the Penal Code.[228] The PSA pointed out that the incident could have been avoided if Equinor had developed better guidelines and instructions regarding how the work should be carried out and better transfer of experience and knowledge following previous gas leak incidents. The PSA later withdrew its statement after the prosecuting authority said that it would be difficult to build a legal case based on the available information from the PSA.[229] Rogaland Police District dropped the case on 28 May 2014, stating that corporate penalties were not judged to be appropriate.[230]

In the period 2013–2017, the PSA conducted 7 audits/verifications of Heimdal and discovered 22 regulatory nonconformities. This is a high number of regulatory nonconformities in comparison with all other production facilities. Only Valemon has a higher average. In supervision from 2016, seven regulatory nonconformities were discovered. The PSA characterised the regulatory nonconformities as serious and afterwards issued Equinor with an order.[231]

225) Petroleum Safety Authority (2012) *Report from the investigation of a hydrocarbon leak on Heimdal, 26 May 2012*, 20 December.
226) Petroleum Safety Authority (2013) *Tilbakemelding på Statoil sitt svar på pålegg etter gransking av uønsket hendelse på Heimdal – hydrokarbonlekkasje 26.5.2012* (Norwegian only). Letter to Statoil, 21 May.
227) Statoil (2013) Møtereferat — *Resultater av aktiviteter som UPN har gjennomført for å måle effekt av tiltak etter alvorlige hendelser* (Norwegian only). Minutes sent to the Petroleum Safety Authority, 10 January 2014.
228) Petroleum Safety Authority (2014) *Gasslekkasje på Heimdal 26.5.2012* (Norwegian only), letter to Rogaland Police District, 15 January.
229) Petroleum Safety Authority (2014) *Gasslekkasje på Heimdal 26.5.2012, ny uttalelse* (Norwegian only), letter to Rogaland Police District, 31 January.
230) Rogaland Police District (2014) *Underretning til klager* (Norwegian only), report number 12088588, registered 29 May 2012. Letter to the Petroleum Safety Authority, 3 June.
231) Petroleum Safety Authority (2016) *Varsel om pålegg etter tilsyn med Heimdal hovudplattform og stigerøyrsplattform – drift, vedlikehald og trykksikringssystem* (Norwegian only). Letter to Statoil, 25 November.

8 Nyhamna

8.1 Background

Nyhamna is located in Aukra Municipality in Møre og Romsdal county and is the landing site for gas from the Ormen Lange gas field. From Nyhamna, the gas is exported via the subsea gas pipeline Langeled, which extends about 1,200 km from Nyhamna to Easington in England.

In 2013 a plan for development and operation of the Aasta Hansteen field in the northern part of the Norwegian Sea was presented before the Storting. As part of this plan, an application was also made to build the gas pipeline Polarled and to expand the gas processing facility at Nyhamna to be able to receive gas from northern parts of the Norwegian Sea.[232] As a result of the expansion of Nyhamna, Gassco took over as operator with AS Norske Shell (hereafter Shell) as technical operator from 1 October 2017. The expansion of Nyhamna to be able to receive and process gas from Aasta Hansteen involved large-scale development of the facility in the period 2014–2017. The development was undertaken in parallel with full operation and was managed by a dedicated project organisation.

The Nyhamna onshore processing facility is, along with Mongstad, the facility that has been subject to the most supervision in recent years. Source: AS Norske Shell

During the development of the facility, a number of incidents occurred there, far more than occurred at the other onshore facilities in the same period. Nyhamna is, along with Mongstad, the facility that has been subject to the most supervision in recent years. The PSA also followed up on Nyhamna through an investigation due to several incidents with falling objects during this period. The facility was also discussed in the media as the result of a whistleblowing case that ended with the dismissal of a safety representative. The PSA has followed up on the working environment and the role of

232) Prop. 97 S (2012–2013) *Utbygging og drift av Aasta Hansteen-feltet og anlegg og drift av Polarled utviklingsprosjekt og Kristin gasseksportprosjekt* (Norwegian only).

safety officers in several supervisory activities. Nyhamna therefore presented an opportunity to look into the authority's follow-up of incidents and reports of concern as well as its supervisory practices.

8.2 The PSA's follow-up of the Nyhamna onshore production facility

In the period 2011–2016 the PSA conducted 11 supervisory activities at Nyhamna; see Appendix 4. Five of the supervisory activities identified several regulatory nonconformities with the topic of working environment:

- 2011 — working environment and chemical exposure:
  - order: that Shell must review its system for managing chemical health risks with the aim of improving it
  - nonconformity: mapping of chemical exposure[233]
- 2013 — working environment and emergency preparedness in security companies: failure to map working environment risks[234]
- 2015 — working environment and material handling in the development project: failure to map working environment risks and lack of employee participation[235]
- 2015 — working environment and safety for workers responsible for insulation work in the development project: failure to map working environment risks and lack of employee participation[236]
- 2016 — follow-up of previous supervision of workers responsible for insulation work: improvement point regarding employee participation[237]

The PSA notes that the supervisory activities with the topic of working environment apply partly to supervision of the operating organisation (2011 and 2013) and partly to supervision of the project organisation (2014, 2015, 2016). The operating and project organisations were two different organisations with different responsibilities. Because there was a major development project on the facility from 2014, much of the authority's attention was directed towards this. Nonconformities that were identified in 2015 were largely the same according to the authority, but they saw that the company made improvements along the way. The findings were not seen as severe enough to be grounds for imposing orders.

Shell stated in an interview that the authority appeared to be consistent and competent in the areas addressed by the supervisory activities.[238] Shell followed up the identified nonconformities and improvement points by registering them in a designated follow-up system. The authority sets deadlines by which time companies are to inform them of how nonconformities and findings are being handled. Shell always makes action plans based on supervision, which they send to the PSA. Afterwards, the PSA replies with its judgement of whether the measures are sufficient.

233) Petroleum Safety Authority (2011) *Tilsyn med helhetlig kjemikaliehåndtering* (Norwegian only), 5 October 2011.
234) Petroleum Safety Authority (2013) *Rapport etter tilsyn med G4S Nyhamna på arbeidsmiljø og beredskap* (Norwegian only), 11 September.
235) Petroleum Safety Authority (2015) *Rapport etter tilsyn med styring av arbeidsmiljø og materialhåndtering under utbyggingen ved Nyhamna* (Norwegian only), 15 January.
236) Petroleum Safety Authority (2015) *Rapport etter tilsyn med Nyhamna om styring av sikkerhet og arbeidsmiljø, vedlikehold og kontroll av stillastutstyr* (Norwegian only), 26 May.
237) Petroleum Safety Authority (2016) *Rapport etter tilsyn med Nyhamna — Oppfølging av funn fra tidligere tilsyn innen arbeidsmiljø og løfteoperasjoner* (Norwegian only), 17 March.
238) Verified minutes from meeting with AS Norske Shell, 21 March 2018.

8.3 Incident reporting

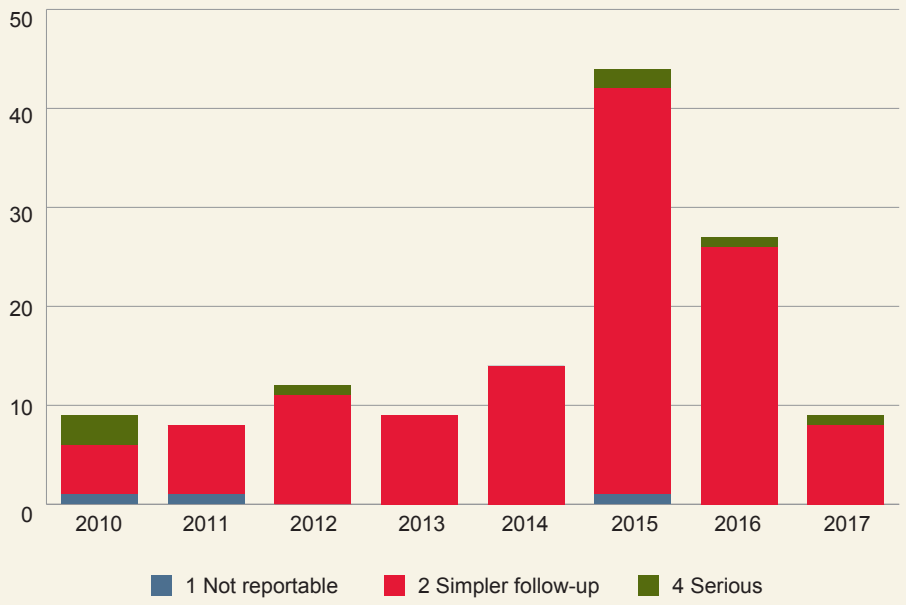
There were 132 incidents at Nyhamna reported in the period 2010–2017; see Table 13.

Table 13 Incidents reported to the PSA in the period 2004–2017*

Degree of severity	Number
5 Large potential/major accident/fatality	0
4 Serious	8
2 Simpler follow-up	121
1 Not reportable	3
Total	**132**

Source: Petroleum Safety Authority
*The PSA only works with four categories for degree of severity; there is no category 3.

Figure 17 Number of incidents reported for Nyhamna in the period 2010–2017 (N=132)



Source: Petroleum Safety Authority

Figure 17 shows the distribution of incidents per year in the period 2010–2017. Many of the reported incidents coincide with the period in which there was major construction activity at the facility in the period 2014–2016.

Table 14 Overview of incidents relating to construction vs incidents relating to operations*

Year	Construction project	Operation
2014	8	7
2015	34	9
2016	17	10
2017	4	9

Source: The Petroleum Safety Authority's incident database
* The division of incidents between development and operation was carried out by the PSA on the request of the Office of the Auditor General in order to see how many of the incidents were related to the development project.

The development project was at its peak in 2015 and 2016. The number of incidents increased markedly in this period, and the majority were related to the development project; see Table 14.

The PSA states that it was particularly concerned with following up the development project at Nyhamna and notes that many of the incidents in 2015 and 2016 are linked to the development, including incidents involving falling objects. The PSA attributes the incidents to the fact that the development had been carried out simultaneously with the operation of the existing facility. This creates special challenges. In major development projects there are often many subcontractors in action. There is a lot of hired labour, and unskilled labour and social dumping can be a problem. Together, these factors create a safety risk. Development projects also involve extensive use of scaffolding. Scaffolding companies also often use hired labourers. These labourers often work for shorter periods and do not develop the same HSE culture as permanent employees. The PSA also observed this trend in several incidents that occurred during the development projects at Kårstø and Melkøya, but to a lesser extent than at Nyhamna. It is therefore important in such development projects that the operator manage the risk and safeguard the working environment.[239]

In November 2015 the PSA decided to investigate AS Norske Shell's follow-up of incidents at the facility, including the handling and follow-up of incidents involving falling objects by the company, suppliers and subcontractors. In slightly different circumstances, some of the incidents (falling scaffolding components and building materials) could have resulted in serious personal injury. The goal of the investigation was in part to clarify the series of events and identify triggers and underlying causes. No regulatory nonconformities were identified by the investigation. Some improvement points were discovered; these mainly related to insufficient requirements in governing documents.[240] Incidentally, the PSA has the impression that Nyhamna has a good reporting culture and that there is a low threshold for reporting incidents. According to the PSA, this may have contributed to the fact that the incident statistics for Nyhamna are high.

239) Verified minutes from meeting with Petroleum Safety Authority, weeks 47 and 48 of 2017.
240) Petroleum Safety Authority (2016) *Nyhamna — Investigation following incidents with falling objects*, 28 January.

8.4 The PSA's follow-up of reports of concern from Nyhamna

8.4.1 Received reports of concern

The PSA received four reports of concern regarding the Nyhamna onshore facility in the period 2015–2017. The case file review indicates that the PSA followed up all four reports in dialogue with Shell, through audits or other means.

One of the reports of concern came from the trade union SAFE and concerned a conflict between the management and the safety officers at Nyhamna. The PSA received the report of concern on 22 April 2015. They were notified of a lack of employee participation, frequent changes of spokespeople and chief safety representatives, and a culture of fear within the organisation.

The PSA followed up the report of concern with an audit the same year. The audit report was released on 26 May 2015.[241] The PSA identified a regulatory breach concerning division into safety areas and training of safety representatives. The safety representatives could not explain which areas they were responsible for. In some places there were also too few representatives to represent many employees, and the safety representatives had insufficient training. The PSA stated in an interview that in their response to SAFE they did not find that the report of concern reflected the conditions at the facility at that time.[242] The PSA also wrote that Shell's response to the audit report and information in the audit indicated that the company addressed the audit problem and developed a framework and a plan to ensure that this would improve in the future.[243] The PSA stated in an interview that they followed up the report of concern and that audits on the topic of employee participation were carried out in 2015,[244,245] and again in 2016.[246]. In one of the audits from 2015, the PSA had meetings with the chief safety representative and safety officers concerning relevant topics at Nyhamna. The chief safety representative and safety representatives had a separate meeting with the PSA and addressed a number of points relating to the cooperation between management, the chief safety representative and the safety officers. After the audits, Shell presented an overview of how they had improved the system following supervision.[247,248]

The PSA followed up with another audit in February 2016 on the topic of cooperation.[249] The PSA observed a number of changes since the previous audit, and found that conditions had improved. The chief safety representative had been dismissed by this time, so the authority was in contact with a new chief safety representative. The chief safety representative at Kværner, who was responsible for the development project, and LO's representative in the project had no criticism of the working conditions at the facility at that time. The PSA believes it performed a thorough examination of the case

241) Petroleum Safety Authority (2015) *Rapport etter tilsyn med Nyhamna om styring av sikkerhet og arbeidsmiljø, vedlikehold og kontroll av stillastutstyr* (Norwegian only), 26 May.
242) Verified minutes from meeting with Petroleum Safety Authority, weeks 47 and 48 of 2017.
243) AS Norske Shell (2015) *Styring av sikkerhet og arbeidsmiljø, vedlikehold og kontroll av stillasutstyr* (Norwegian only). Letter to the Petroleum Safety Authority, 7 August.
244) Petroleum Safety Authority (2015) *Rapport etter tilsyn med styring av arbeidsmiljø og materialhåndtering under utbyggingen ved Nyhamna* (Norwegian only), 15 January.
245) Petroleum Safety Authority (2015) *Rapport etter tilsyn med Nyhamna om styring av sikkerhet og arbeidsmiljø, vedlikehold og kontroll av stillastutstyr* (Norwegian only), 26 May.
246) Petroleum Safety Authority (2016) *Rapport etter tilsyn med Nyhamna — Oppfølging av funn fra tidligere tilsyn innen arbeidsmiljø og løfteoperasjoner* (Norwegian only), 17 March.
247) AS Norske Shell (2015) *A/S Norske Shell — Materialhåndtering og arbeidsmiljø Nyhamna* (Norwegian only). Letter to the Petroleum Safety Authority, 6 February.
248) AS Norske Shell (2015) *Styring av sikkerhet og arbeidsmiljø, vedlikehold og kontroll av stillasutstyr* (Norwegian only). Letter to the Petroleum Safety Authority, 7 August.
249) Petroleum Safety Authority (2016) *Rapport etter tilsyn med Nyhamna — Oppfølging av funn fra tidligere tilsyn innen arbeidsmiljø og løfteoperasjoner* (Norwegian only), 17 March.

and feels that Shell responded in a satisfactory manner to what was identified through supervision.[250]

Afterwards, the PSA evaluated its own role. The background was that one of the topics of the supervision was employee participation, and that the report of concern was about a conflict between the safety representatives and the company. Even though Shell's operating model and HSE management at Nyhamna followed a foreign model, the PSA found that they must be clear as to the boundaries of their jurisdiction. The authority's responsibility is to follow up as to whether companies have procedures and systems for internal notification. The right of employees to notify and not be subject to reprisal is beyond the PSA's area of responsibility.

Shell stated in an interview that the notification case in 2015 and the conflict with the previous chief safety representative at Nyhamna were difficult to handle, but that they reached a solution through private law. Today, the company feels that HSE conditions at Nyhamna are good. The trade unions that are active at Nyhamna are divided in their opinions of whether the working environment is good and the safety service is functioning. One trade union has good experience and finds that company management addresses working environment challenges when the union brings them up. Another trade union believes that the safety service is still not functioning at Nyhamna despite the audits that have been conducted. This union feels that the position, role and influence of the safety service are challenged by company management, and that spokespeople and safety representatives do not have much involvement in decision-making processes concerning the working environment. The union feels that the PSA does not adequately investigate whether the company addresses the nonconformities and improvement points that the authority identifies in its audits.

250) Verified minutes from meeting with Petroleum Safety Authority, weeks 47 and 48 of 2017.

9 Mongstad

9.1 Background

The Mongstad onshore processing facility is a large industrial area consisting of several industrial facilities with different functions.[251] Since the oil refinery was opened for operations in 1975, the area and activities have expanded greatly and now consist of the following:

- **Oil refinery:** The refinery at Mongstad is the largest of two refineries in Norway and has a capacity of 12 million tonnes of crude oil per year. Half of the production is for Norwegian consumption, and the other half is exported. Petrol, diesel, aviation fuel and other petroleum products are produced here. Equinor is the operator of the facility, which is 100 per cent owned by Equinor Refining Norway AS.

- **Crude oil terminal:** Mongstad Terminal DS receives a large portion of the Equinor-produced oil on the Norwegian continental shelf, including the state's portion. The facility consists of three dock facilities and six caverns. It receives oil from Gullfaks, Draugen, Norne, Åsgard, Heidrun and others. It also receives oil transported from the Troll oil field via pipeline. Starting in late 2019, oil from Johan Sverdrup will also be landed at Mongstad. The oil is stored at Mongstad before being exported to customers in Europe, the US and Asia. The terminal receives roughly 500 ships per year. The facility is owned by Equinor (65 per cent) and Petoro (35 per cent).

- **Vestprosess DA:** The facility receives NGL through a pipeline from Kollsnes via Sture. NGL is separated into different products (naphta, propane, butane). Naphta is used in the production of petrol at the facility, whilst propane and butane are exported for use by the petrochemical industry in other parts of the world. The facility is owned by the State (41 per cent), Equinor (34 per cent), ExxonMobil (10 per cent), Shell (8 per cent), Total (5 per cent) and ConocoPhillips (2 per cent).

- **Mongstad cogeneration plant:** The cogeneration plant supplies the refinery with electricity and heat. It is owned by Equinor alone.

- **CO2 Technology Centre:** The world's largest centre for testing and development of CO2 capture technology started operations in 2013. The facility is owned by Gassnova (75.1 per cent), Equinor (20 per cent), Shell (2.44 per cent) and Sasol (2.44 per cent).

251) Statoil (2017) *Sikkerhetsrapport for allmennheten — Hovedrapport ST-11385-6* (Norwegian only), 17 February; Statoil (2017) *Lekkasje av H2 rikt prosessmedium i område A-1200 på Mongstad* (Norwegian only). Investigative report, 13 January.

Cuts to appropriations for maintenance work, in combination with the failure to follow up on regulatory nonconformities, contributed to the serious incident at the Mongstad onshore production facility in 2016. Source: Helge Hansen, Equinor

Mongstad is a large onshore facility with significant petroleum activity. Along with Nyhamna, Mongstad is the facility that has been subject to the most supervision from the PSA in the period 2013–2017. In recent years it has come to light that the facility has faced major maintenance challenges, and several serious incidents occurred in the period 2010–2017. In 2016 a hydrogen leak occurred that could have resulted in a major accident and death. In their own investigation, Equinor noted that the incident was related to the fact that maintenance was not prioritised highly enough. An case study of Mongstad provides the opportunity to evaluate the authority's supervisory practices at the facility over time from the perspective of the serious incident that occurred in 2016. Mongstad also provides the opportunity to see how the authority followed up on incident reporting and reports of concern.

Mongstad was in the media spotlight following an cyber security incident in 2014. The PSA chose to call Equinor's management to a meeting in November 2016, and also followed up on the company through an audit reported in 2017. Mongstad therefore provides the grounds to evaluate the PSA's supervisory practices in the area of cyber security.

9.2 The gas leak at Mongstad in autumn 2016

Corrosion under insulation is a challenge for many onshore and offshore production facilities and can lead to incidents with the potential for major accidents.[252] The companies have maintenance programmes in which they prioritise maintenance in the areas of their facilities with the highest risk of leakage and that would suffer the worst consequences in the event of a leak. This practice requires a good level of knowledge of the state of the facility if the need for maintenance is to be covered.

252) Ministry of Labour and Social Affairs (2017) *Health, safety and working environment conditions and trends in the Norwegian petroleum industry.*

Corrosion under insulation was the topic of a report published by the PSA in collaboration with Oceaneering in January 2018.[253] The report states that there is major concern for the state of ageing insulated equipment in the petroleum industry. The report explains that this concern is based on the following conditions:

- As a rule, water penetration and corrosion will always affect insulated pipes over time, and this is difficult and costly to identify.
- The scope of insulated pipes varies greatly, and the scope of insulation on many installations is large.
- Surface treatment and insulation are generally carried out by unskilled labourers.
- Contracts offered to insulation companies often do not allow for sufficient quality assurance of the work, and requirements for quality assurance are often not included in the contract.
- The insulation work on installations built in East Asia after 2010 has known deficiencies. The quality of the work is not a high priority because insulation work is one of the final steps in the manufacturing phase. When there are delays in manufacturing there is therefore little time left for the insulation work, and the quality and quality assurance suffer.
- There have been major cuts to the scope of condition monitoring as a result of budget cuts in the industry in recent years. The number of working hours that contractors spent on maintenance and operations offshore was halved in the period from 2013 to 2016 in spite of the fact that the number of older installations increased.

On 25 October 2016 a leak of hydrogen-rich gas occurred in connection with planned maintenance of a petrol plant at Mongstad. The leak occurred when an operator turned a valve on a pressurised pipe that contained hydrogen-rich gas. The valve broke off, allowing the gas to flow out. If the gas had been ignited, it could have resulted in the loss of one or multiple human lives. The PSA's investigation identified the cause as corrosion under insulation. The pipe was so rusted-through that it broke when the operator touched it.[254] Equinor classified the incident with the highest degree of severity. This means that, under slightly different circumstances, it could have resulted in the loss of human life.[255]

The PSA's investigation identified several serious breaches of the regulations:

- the facility was not properly maintained. The need for and the risk associated with surface maintenance was not adequately reflected in plans or budgets;
- insufficient risk analysis prior to commencement of activity. Stripping and inspection took place whilst the facility was in operation. This carried a major risk on its own, and this was not addressed to a sufficient extent through compensatory measures;
- insufficient information about risks. The operators were not informed of the risk associated with the ongoing stripping and inspection;
- insufficient control of personnel upon evacuation.

Following the investigation, Equinor was issued with an order to establish robust plans for the facility's surface programme with regard to time and resources to ensure that the facility is properly maintained.[256]

The PSA carried out a follow-up audit in January 2018. They noted an improvement point concerning the capacity of the drainage system. The audit indicates that Equinor

253) Oceaneering (2018) *Insulation solutions and safety challenges from a historical perspective* (in Norwegian with English summary). Report no. 2017/957.
254) Petroleum Safety Authority (2017) *Gas leak at Statoil Mongstad on 25 October 2016*, 6 March.
255) Statoil (2017) *Lekkasje av H2 rikt prosessmedium i område A-1200 på Mongstad* (Norwegian only). Investigative report, 13 January.
256) Petroleum Safety Authority (2017) *Report of the investigation into the gas leak at Statoil Mongstad on 25 October 2016 — notice of orders*. Letter to Statoil, 7 March.

increased its maintenance work in 2017 and 2018. They carried out and planned three to four times more surface maintenance than was the average in previous years.[257]

9.2.1 Equinor's investigative report of the gas leak

In its report dated 19 January 2017 Equinor concludes that the gas leak in 2016 was of the highest degree of severity, and that the incident could have turned into a major accident if more personnel had been in the area when the incident occurred.[258] The report identifies several underlying causes that were "linked to a series of technical failures, decisions, design-related conditions, operational practices, organisational conditions, and more".[259] Among the identified conditions were the following:

- The pipe end had not undergone maintenance since 1983 — all paint and surface treatments were gone or degraded. The A-1200 plant where the incident occurred was not prioritised for surface maintenance work and actually should have been inspected or maintained before 2013.
- According to Equinor's strategy for surface maintenance at Mongstad in the period 2007–2013, all corrodible pipes should have been inspected or maintained by 2014. Only 45 per cent were inspected or maintained prior to the incident in 2016.
- Challenges involving quality and competence with the external supplier of insulation workers led to insufficient execution of the surface maintenance strategy.
- The progress plan for surface maintenance was delayed several times for financial reasons. In 2010, 2011 and 2012 the decision was made to decrease the budget without first conducting risk analyses. It also appears that surface maintenance was determined by the allocated budget and finances, rather than risk and technical conditions.
- Established practices for maintenance management at Mongstad were not in line with the company's own governing documents. There were unclear roles and responsibilities, lack of influence, and frustration among technical personnel at the facility over a large and growing maintenance backlog.

The investigation also identified a gap between the expectations for progress in maintenance efforts and the realism of the plans that had been set forth. A new surface maintenance strategy for the period 2015–2021 will ensure that all corrodible insulated pipes will be rehabilitated by 2022, and the rest by 2030. The investigation group judged the plan to be unrealistic. The investigation group also noted that there have been a significant number of leaks in hydrocarbon systems over many years at Mongstad (19 in the period 2010–2016). This indicates on a purely statistical basis that there are many instances of significant corrosion that have not yet caused a leak.

Several trade unions with spokespeople and safety representatives at Equinor state that there was internal notification within the company about the conditions that led to the incident in 2016, but that this was not prioritised by Equinor's management at Mongstad. The trade unions note that similar incidents have taken place on other Equinor installations, such as Gullfaks and Kårstø. According to one of the trade unions, there were reports of challenges linked to corrosion under insulation at Mongstad in 2001, 2011 and 2013. In 2013 the plant that experienced the leak 2016 was mentioned explicitly in Equinor's internal reporting tool, TIMP. The notifications continued in 2014 and 2015, but the trade union says these were not addressed due to budget cuts.

257) Petroleum Safety Authority (2017) *Tilsyn med Statoil — Mongstad* (Norwegian only), 21 March.
258) Statoil (2017) *Lekkasje av H2 rikt prosessmedium i område A-1200 på Mongstad* (Norwegian only). Investigative report, 13 January.
259) Statoil (2017) *Lekkasje av H2 rikt prosessmedium i område A-1200 på Mongstad* (Norwegian only). Investigative report, 13 January.

Equinor stated in an interview that there are problems with corrosion on all of the company's installations, but that the challenge is the greatest at Mongstad, where there have been a high number of leaks resulting from corrosion under insulation.[260] The reasons for this include the way the plant was built and the fact that parts of the plant are old. According to Equinor, the original design and the selected insulation solutions have more recently presented challenges. This is part of the reason why the maintenance backlog is so large. Corrosion under insulation is therefore ranked highly in the comprehensive risk analyses for Mongstad. After the incident in 2016, Equinor recognised that the corrosion challenges were not adequately understood, and the company therefore decided to increase the intensity of surface maintenance.

Equinor states that they responded to the PSA's investigation both in writing and in meetings. The PSA had a meeting with Equinor to follow up on the measures in the order in June 2017. The PSA also conducted a follow-up audit in January 2018 to see how Equinor had followed up on the conditions identified in the investigation. Equinor feels that the PSA followed up on the case in a proper manner and that they were more active in this follow-up than what Equinor had experienced in previous investigations. Equinor believes the adjustment that the PSA made in following the case all the way, that is to say by conducting follow-up supervision to confirm that Equinor had implemented the necessary measures, was appropriate.

Equinor believes that there is a good degree of correlation between Equinor's own reports and the PSA's report, and that they identify largely the same causes. In the past two years, Equinor Mongstad has experienced more professional supervision than previously, and Equinor feels that the PSA is going more case in its supervisory activities. Equinor does not have entirely positive feelings about this. Equinor believes that the company itself should be the one to identify the best way to operate, and if the PSA goes too far with its follow-up it can become unclear as to who makes decisions or who is responsible for how things are done.

Equinor finds that facilities that have had many findings and incidents are also subject to more follow-up and supervision from the PSA. Equinor feels that this is in line with the PSA's risk-based supervisory practices.

9.2.2 The PSA's follow-up of corrosion under insulation at Mongstad — serious incidents and subsequent investigations

The PSA is aware that corrosion under insulation is a common phenomenon at Mongstad. Mongstad is an old refinery that was developed in several stages, and the authority finds that the facility's age presents a challenge with regard to maintenance.[261] The pipes are insulated in order to maintain a stable, correct temperature for processes and to prevent freezing in winter. Steam pipes are used under the insulation as a heating element to prevent freezing. According to the PSA, this contributes to an increased risk of corrosion.

Over time, there have been several serious incidents at Mongstad in which corrosion under insulation was a central contributing factor:

- 8 February 2010 — gas leak due to an accident in connection with maintenance work
- 8 November 2012 — steam leak due to corrosion under insulation
- 25 October 2016 — gas leak due to corrosion under insulation

260) Verified minutes from meetings with Statoil, 12 March and 25 April 2018.
261) Verified minutes from meeting with Petroleum Safety Authority, 27 April 2018.

The incidents were investigated by the PSA. The incident in 2016 had several factors in common with the incident in November 2012. All of the incidents resulted in leaks with the potential to cause major damage and the risk of death or injury.[262]

The gas leak in 2010 occurred in connection with insulation work on a pipe carrying liquefied petroleum gas under high pressure and temperature. The work being carried out had been initiated in order to rectify corrosion under insulation. An insulator from the subcontractor Kaefer drilled a hole in a pipe, and this resulted in a leak.[263,264]
The PSA's investigative report identified the following nonconformities:

- Insufficient risk analysis — risks associated with HSE were not sufficiently elucidated prior to commencement of work. Reference is made to the corresponding incident at Melkøya, and to the fact that Equinor and Kaefer should have used the experience gained from this to identify and analyse risks.
- Insufficient competence and understanding of risks — the insulators had not received sufficient education and did not have sufficient competence and understanding of risks.

On 8 November 2012 a powerful steam leak occurred at Mongstad as a result of corrosion under insulation. No one was harmed, but the incident had a high potential for harm and could have led to the loss of four human lives.[265] The PSA points to three regulatory breaches in its investigation:

- The system for control of corrosion under insulation is not fully taken care of.
- Corrosion follow-up of pipes and systems that are used periodically, and therefore experience changes in temperature, is not adequately taken care of.
- The PSA was notified too late of the danger and accident situation. Serious danger and accident situations must immediately be made known to the PSA by telephone, but Equinor first sent a written notification four days after the incident.

Six improvement points were also identified. The PSA points to insufficient risk analyses and lack of progress in the surface programme that Equinor had initiated at Mongstad to inspect and rectify corrosion under insulation.Equinor explained how they followed up the investigation in a letter dated 23 April 2013; see Appendix 5.[266] In the letter, Statoil refers to measures that have been implemented. The letter contains no reference to the conditions that appear in the company's investigation following the incident in 2016, including that planned maintenance had not been carried out due to financial cuts to the maintenance programme in the years 2010, 2011 and 2012. In a letter to Equinor dated 12 September, 2013, the PSA concluded its investigation with reference to the company's letter of reply.[267] The letter states that the results of activities described by Equinor can be added as verification points in later supervision. The PSA believes the nonconformities from the investigation were followed up in an audit conducted in January 2016. No nonconformities were identified in the 2016 audit. They did, however, identify two improvement points concerned with a substantial increase in the number of leaks at the facility, as well as the failure to assess the total need for surface maintenance at the facility in terms of specific plans and/or budgets. The PSA did not carry out verifications in connection with the supervision of the company's follow-up of the regulatory nonconformities in the period from 2013 until the gas leak occurred in autumn 2016.

262) Petroleum Safety Authority (2017) *Gas leak at Statoil Mongstad on 25 October 2016*, 6 March.
263) An insulator insulates pipes, channels, tanks and equipment in the industry, on oil and gas installations, in shipyards and in commercial buildings.
264) Petroleum Safety Authority (2010) *Investigative report — Gas leak at Mongstad 8 February 2010*, 22 March.
265) Petroleum Safety Authority (2013) *Granskingsrapport — Damplekkasje på Mongstad 8.11.2012* (Norwegian only), 8 March.
266) Statoil (2013) *Svarbrev til Petroleumstilsynet på granskingsrapport etter damplekkasje 8.11.2012 på Mongstad* (Norwegian only). Letter to the Petroleum Safety Authority, 23 April.
267) Petroleum Safety Authority (2013) *Avslutte gransking etter uønsket hendelse, damplekkasje på Mongstad 8.11.2012* (Norwegian only). Letter to Statoil, 12 September.

In addition to the incidents caused by corrosion under insulation, there were several incidents caused by internal corrosion in pipes. In 2017 alone there were two serious gas leaks caused by internal corrosion. The PSA investigated one of the incidents and identified four regulatory nonconformities:[268]

- insufficient analysis when changing operating conditions
- deficiencies in maintenance and inspection
- insufficient compliance with procedures and transmission of information for safe operation of the facility
- insufficient understanding of risks and failure to identify risk factors when cleaning up materials contaminated with naphta

The other incident in 2017 was only investigated by Equinor and not by the PSA. In their investigation, Equinor concluded that the incident was caused by internal corrosion, and that it had a degree of severity indicating a potential danger for serious personal harm.[269] Equinor's investigation contained the following conclusions and main learning points:

- Organisational barriers for avoiding hydrocarbon leaks caused by corrosion must be strengthened.
- Technical barriers in the facility where the incident occurred must be strengthened.
- Proper patterns for action in the event of a confirmed leak must be ensured.

9.2.3 The PSA's follow-up of corrosion under insulation at Mongstad — supervision and follow-up of incidents and reports of concern

Supervision

In the period 2011–2018, the PSA conducted 15 audits at the Mongstad onshore production facility; see Appendix 5. Of the 15 audits, 6 were concerned with challenges linked to maintenance, but only 3 of those 6 had maintenance as their topic (the audits in 2011, 2014 and 2016).

- The 2011 audit had maintenance management as its topic, and several nonconformities were identified, including the lack of a plan for maintenance activities.
- The 2014 audit examined the use of scaffolding and also identified several nonconformities.
- In 2016 an audit was conducted with regard to surface maintenance and corrosion under isolation. The audit report notes two improvement points.[270] It is noted that the number of leaks had increased markedly from 2014 to 2015, and that roughly half of the leaks resulted from corrosion under insulation. The report states that the underlying causes of the occurrence of several leaks had not been addressed. It is also noted as an improvement point that the total need for surface maintenance is not assessed in specific plans or budgets. The PSA also states in the report that there is a general recognition at Equinor that the need for maintenance is great, and that the use of resources must be optimised. It is noted that the amount of resources used for surface maintenance was increased in 2015, and that the budget for 2016 also increased. It does not say by how much. The audit report is brief and without reference to the possible consequences of the increased number of leaks.

The PSA's follow-up of the audits in 2011 and 2014 is documented in Appendix 5. The PSA did not verify that Equinor had rectified the regulatory nonconformities identified in the audits.

268) Petroleum Safety Authority (2018) *Mongstad refinery — Naphtha leak in cracker, 24 October 2017*, 19 February.
269) Statoil (2018) *LPG lekkasje i A-1400 på Mongstad 30.07.2017* (Norwegian only). Investigative report, no date.
270) Petroleum Safety Authority (2016) *Tilsyn med overflatevedlikehold og korrosjon under isolasjon hos Statoil Mongstad* (Norwegian only), 9 February.

The PSA states that the 2016 audit was directed towards Equinor's systems for follow-up of surface maintenance and risk-based inspection planning. There were no verifications of corrosion under insulation carried out at the facility. In hindsight, the PSA admits that they could have carried out verifications to good effect. As for the manner in which the audit was carried out, the PSA feels that they did not have sufficient proof or information to be able to formulate the findings as nonconformities. The audit had been one in a series dealing with corrosion under insulation at onshore processing facilities.

According to the PSA, two follow-up activities were carried out following the gas leak in 2016. The first was conducted as a meeting with an inspection of the facility in June 2017, whilst the other was a follow-up audit in January 2018. The meeting in June 2017 was a direct follow-up of Equinor's response to the authority's report following the investigation, while the goal of the follow-up audit in 2018 was to review the status of Equinor's measures and improvements that were carried out following the incident. Equinor's investigative report was part of the basis for these activities. Supervision of the quality of work on the surface project, and particularly with regard to increased resource use and execution capabilities, was an important part of the PSA's follow-up after the incident. The PSA noted that activity on the project had increased significantly, and the parts of the facility that were thought to have the highest safety risk had been given the highest priority by Equinor.

The PSA initiated several activities aimed at corrosion under insulation following the leak at Mongstad in 2012. The PSA notes that corrosion under insulation is a pervasive problem at several onshore facilities as well as on the Norwegian continental shelf. After the incident in 2016 it became clear that Mongstad was facing major challenges and was behind in these efforts. In hindsight, the PSA sees that it should have gone to Mongstad earlier and conducted more verifications at the facility during its supervision in 2016. Nevertheless, the authority feels that the identification of nonconformities and orders would not necessarily have prevented the incident of autumn 2016.

One trade union states that the PSA had conducted several audits over a long period of time (2011–2016) with the same findings of insufficient maintenance, but claims that they did not follow up the audit reports and investigations. The union has the impression that the PSA believe themselves to be finished with a case once the investigation or supervision has been completed. Another trade union feels that the authority's follow-up of Mongstad was not risk-driven. As the union sees it, the authority did not do an adequate job of following up one of the greatest risks facing Mongstad over time, namely gas leaks resulting from corrosion problems. The trade union sees the value of supervision campaigns with an emphasis on prioritised topics, but the authority must also have the resources to be able to follow up the individual facilities following findings, incidents, notifications and risk analyses.

The PSA stated in an interview that they have found that measures to rectify nonconformities or follow up improvement points following supervision can be given a low priority in the companies' internal budget processes. This is part of the reason why the authority now conducts several follow-up audits to confirm that the measures a company implements following identified nonconformities are followed up in line with what is described in their response to the PSA's audit reports. According to the PSA, Equinor's investigation indicated that the company had more knowledge of the problem's scope than the PSA was informed of in the audit that was carried out in 2016.

Incidents

In the period 2010–2017, 92 incidents were reported in connection with the Mongstad onshore processing facility. Table 15 shows how the incidents are distributed based on degree of severity.

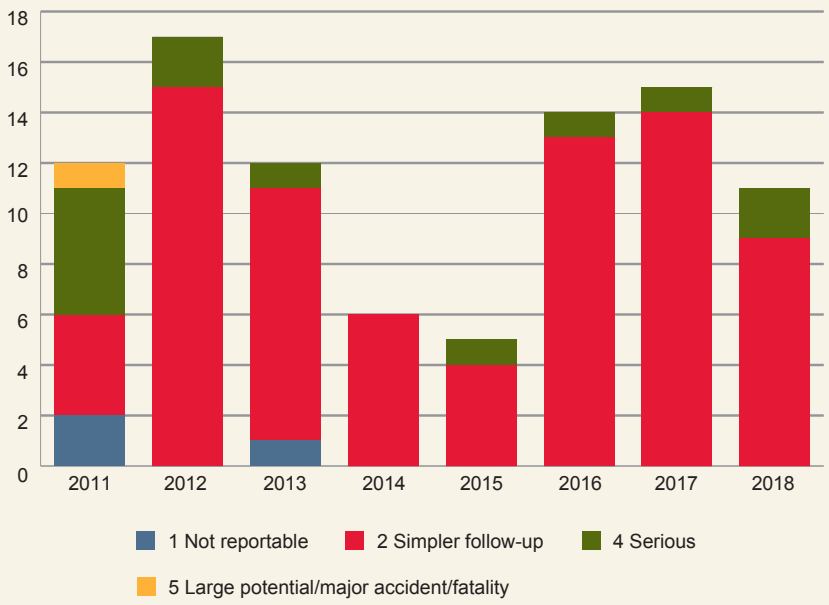
Table 15 Incidents reported in the period 2010–2017 by degree of severity

Degree of severity	Total
1 Not reportable	3
2 Simpler follow-up	75
4 Serious	13
5 Large potential/major accident/fatality	1
Total	**92**

Source: Petroleum Safety Authority

The majority of the incidents are those that require simpler follow-up and have a low degree of severity.

Figure 18 Number of incidents reported for Mongstad in the period 2010–2017 (N=92)



Source: Petroleum Safety Authority

Figure 18 shows how the incidents are distributed according to degree of severity by year in the period. The incident with major accident potential in 2010 was a gas leak. Of the 13 incidents categorised as serious, five occurred in 2010. In the period 2014–2017, at least one serious incident occurred per year. Two incidents occurred in 2017. Both were gas leaks and both were due to internal corrosion.

Mongstad is a company with major accident prevention obligations and is therefore obliged to prepare a safety report every five years.[271] The latest safety report was released in 2017. The report shows that hydrocarbon leaks present a significant risk of major accidents at Mongstad, and that poor maintenance is in many cases a key factor in the occurrence of leaks. The report includes an evaluation of which incidents have major accident potential. Hydrocarbon leaks at processing facilities or external facilities and poisonous gas leaks are identified as incidents involving a danger of major accidents.[272] The report includes an analysis of all hydrocarbon leaks in land-based petroleum activities in Norway and their causes. It is noted that 42 of the 103 leaks that were reported to the PSA in the period 2006–2015 occurred at Mongstad. Six of the leaks resulted in ignition, and five of these occurred at Mongstad. It is also noted that poor system maintenance was the cause of 12 leaks in the period 2013–2015.

Reports of concern

The PSA received five reports of concern regarding Mongstad in the period 2011–2016, and three of these related to social dumping (pay and working conditions for hired labourers) at Mongstad. The PSA believes that the last two fall outside their area of responsibility. The three cases relating to social dumping are from 2012, 2014 and 2016. The notifications concern the same supplier of services at Mongstad.

The PSA sees no correlation between the reports of concern regarding social dumping at Mongstad and the challenges of corrosion under insulation (CUI) at the facility. The challenges relating to CUI are connected with the planning of maintenance campaigns and whether enough resources have been dedicated to their execution. Social dumping is connected with pay and working conditions for contractors. The reports of concern regarding social dumping are, according to the authority, relevant for the personnel working with maintenance, including the effort to improve conditions connected to CUI. The PSA states that the reports of concern were followed up through unannounced audits of Mongstad and Kårstø in collaboration with the police, the Tax Administration and the Labour Inspection Authority.[273] The 2015 audit focused on pay and working conditions for foreign workers within insulation, scaffolding and surface treatments. The PSA stated in an interview that, in connection with the report following supervision and identified nonconformities there was a need to clarify the scope of the regulations of 6 October 2008 on general application of wage agreement for construction sites in Norway. A clarification from the Tariff Board resulted in the audit reports being withdrawn and not published. The authority also states that experiences from follow-up of at-risk groups indicate that employees who work with insulation, maintenance and modification have a higher risk exposure than other employee groups. This is therefore a group that the authority follows closely.

9.3 The PSA's follow-up of cyber security at Statoil resulting from an cyber security incident at Mongstad in 2014

On 21 May 2014 a server at Mongstad was restarted by an employee of the Indian company Hindustan Computing Limited (HCL) from India. HCL was hired by Equinor in 2012 to perform ICT services for the company. The server was restarted while loading of 50 million litres of petrol to a tank ship docked at Mongstad was taking place.

271) In accordance with Section 9 of the Storulykkeforskriften (Norwegian implementation of Council Directive 96/82/EC of 9 December 1996 on the control of major-accident hazards involving dangerous substances), companies with major accident obligations are required to prepare safety reports every five years or more often.
272) Statoil (2017) *Sikkerhetsrapport for allmennheten — Hovedrapport ST-11385-6* (Norwegian only), 17 February.
273) Sysla, online edition 11 January 2017: *Derfor fikk du aldri vite resultatet av storaksjonen* (Norwegian only).

As a result, the mixing of the load had to be carried out manually, and caused Equinor to suffer a financial loss of 200,000 NOK.

Two years later, on 28 October 2016, Equinor's management was called to a meeting with the PSA after the case was picked up by the media.[274] In the meeting, the company explained how they had handled the incident. The PSA was satisfied with Equinor's explanation in the meeting, and agreed that the incident was not critical to safety. Nevertheless, in November/December 2016 the PSA chose to conduct an audit of Equinor Mongstad and the company's handling of incidents linked to ICT and information security.

9.3.1 Audit of Equinor's cyber security

After the PSA became aware in autumn 2016 of the cyber security incident at Mongstad, they announced an audit focused on Equinor's handling of incidents linked to ICT and information security. The audit report was published on 31 January 2017.[275]

The audit was announced on 31 October, 2016, and conducted in the form of meetings with Equinor on 3 November and 9 December 2016, in addition to a document review carried out on 8 December 2016.[276] According to the audit report, the goal of the audit was "to verify that Statoil has robust solutions for barrier management within information security for security and control systems by focusing on Statoil's handling of incidents connected to ICT and information security". According to the report, the PSA also "followed up barrier management for information security for security and control systems". The PSA stated in the audit report that they did not look at risk analyses in connection with the outsourcing of ICT services to HCL in India because this decision was made for financial reasons. The PSA points out that they were aware of the fact that there had been several incidents connected with the outsourcing, and that this was the basis for conducting the audit. The authority concluded that Equinor had handled the incident well, and there was only one improvement point registered, which concerned the duty to notify. This was based on Equinor's internal case study, which points out that the incident could have potentially resulted in "impairment/loss of security features and barriers".

The goal of the audit as formulated in the audit report was to verify whether Equinor had "robust solutions for barrier management". Equinor conducted a case study of the incident in 2014 to support internal learning, prevent repeat incidents and improve HSE[277] The report concluded that two barriers were breached, two barriers were missing and one barrier was weak. It identified insufficient compliance with internal requirements, insufficient risk analysis, insufficient leadership and management, and potential for improvement with regard to the transfer of experience from previous similar incidents in the company. It is noted that there had been several previous incidents involving unauthorised logins at the facility and at Equinor in general. According to the study, measures resulting from these incidents were not adequately followed up, and measures were marked as completed in the company's archive system Synergi even if they had in fact not been implemented. Among the potential consequences, the study mentions the danger of failure of the refinery, impairment/loss of safety functions/barriers, loss of reputation and production losses at a magnitude of 15–20 MNOK.

274) NRK, online edition 28 October 2016: *Tastefeilen som stoppet Statoil* (Norwegian only).
275) *Audit of IT security within Statoil.* <http://www.ptil.no/audit-reports/audit-of-it-security-within-statoil-article12578-889.html> http://www.ptil.no/audit-reports/audit-of-it-security-within-statoil-article12578-889.html> [16 August 2018].
276) Petroleum Safety Authority (2017) *Statoil sin håndtering av hendelser knyttet til IKT og informasjonssikkerhet, og tilhørende barrierestyring* (Norwegian only). Audit report, 30 January.
277) Statoil (2014) *Dybdestudie av RUH 1405809 — Restart av SEPTIC Server MO-WP03* (Norwegian only), 4 July.

The PSA received this report in connection with its audit.The audit report does not note nonconformities or improvement points relating to breached, impaired or missing barriers. The PSA notes in an interview that it looked at 97 incidents in the company, not only the incident at Mongstad, and at barriers that were breached in these incidents. The authority states that the incidents were not within what they consider to be their area of responsibility, because they concerned administrative systems. The barriers that were breached were not serious enough to disrupt operations at the facilities (for example, improper use of a flash drive), and the PSA therefore considered it to be Equinor's responsibility to deal with this.

The PSA believes that Equinor has good control of its own cyber security, and that the company has made positive contributions to standards and knowledge development in this area in the industry. The National Security and Norcert have confirmed to the PSA that Equinor has a good basis for being able to assume responsibility for this subject area. It is Equinor that bears the risk in the event of errors and deficiencies, and it is the company's own responsibility to control its own cyber security, according to the PSA. The way the company is run and what systems it chooses to use are not part of the authority's area of responsibility.

Equinor regards IT firewalls and IT infrastructure as barriers at its facilities. The deficiencies in access control and IT barriers that were discovered at Mongstad in 2014 concerned not only Mongstad but all of Equinor's facilities to some extent, according to the case study. Two trade unions disagree with the PSA's judgement that the breached barriers documented in Equinor's case study fall outside of the authority's area of responsibility. With its professional insight and requirements for barrier independence (see Section 5 of the Management Regulations and sections 32–34 of the Facilities Regulations), the authority should have, according to one of the trade unions, already asked critical questions in 2011 concerning the risk analysis of outsourcing operational tasks, connections to the plants and independence.

9.3.2 Equinor's follow-up of the cyber security incident at Mongstad

Equinor emphasises that four years have passed since the incident in 2014, that Equinor's knowledge and competence in this field are greater now, and that a lot has happened in the industry as a whole since 2014. Equinor feels that the PSA has developed competence in cyber security in recent years, and that they have gained more resources for this through the letters of commitment from the Ministry of Labour and Social Affairs. According to Equinor, the PSA has only conducted one audit of Equinor in this area in recent years.[278]

Equinor is in the process of evaluating its internal procedures for the outsourcing of ICT services. Regarding cyber security-related challenges in connection with the outsourcing of ICT services to an Indian company, Equinor did not conduct an internal investigation, but rather something that could be described as a review. Equinor does not wish to comment on the review or on internal changes that have been made since then. According to Equinor, any reasons for or challenges involving outsourcing and access control are related to business operations and fall outside the PSA's area of responsibility. The PSA was also not involved in the work that led Equinor to decide to move the maintenance of firewalls at Mongstad from India back to Norway. The matter was, however, discussed in routine meetings between the PSA and Equinor, but as part of a larger agenda.

278) *Audit of IT security within Statoil.* <http://www.ptil.no/audit-reports/audit-of-it-security-within-statoil-article12578-889.html> http://www.ptil.no/audit-reports/audit-of-it-security-within-statoil-article12578-889.html> [16 August 2018].

According to two trade unions, Equinor chose to review its security procedures after the incident became known to the media in autumn 2016. According to one of the trade unions, a working group was appointed with the task of reviewing cyber security at Equinor's facilities. The group's primary conclusion was that security-critical work carried out by HCL needed to be brought back to Norway and carried out by Equinor's own employees. The two trade unions state that steps have been taken and measures have been implemented to address cyber security in the company. This has happened in spite of, not because of, the PSA's follow-up of the incident, according to the two trade unions. According to one of the trade unions, Equinor made no secret of the fact that the changes came as a direct result of the ICT incident. Nevertheless, the trade unions believe that a fair amount of work still remains to implement the measures identified by the working group.

9.3.3 The PSA's responsibility for follow-up of cyber security in the petroleum industry

The PSA's responsibility for cyber security is not enshrined in laws or regulations, but follows from its general responsibility for safety in the petroleum industry and delegated responsibility for Section 9-3 of the Petroleum Act, Preparedness against deliberate attacks.[279] The PSA stated in an interview that the provisions of the Petroleum Act concerning safeguarding also include cyber security for industrial control systems. The PSA also stated in an interview that the regulatory responsibility is limited to industrial control systems and the barriers that protect them. Administrative ICT systems are not included in the regulatory responsibility according to the authority's definition.

The PSA stated in an interview that cyber security has been followed up ever since the Norwegian Petroleum Directorate gave the go-ahead for integrated operations in 2003. Following this decision, the PSA asked what the companies would do to secure data communication with the platforms from land. The industry then, through Norwegian Oil and Gas, developed its own guidelines *(104 Recommended guidelines for information security baseline requirements for process control, safety and support ICT systems)* in 2006. The guidelines state requirements for the safeguarding of various industrial systems and organisational conditions surrounding cyber security, but do not address office networks and administrative cyber security systems or the protection of these. The guidelines have no legal status, but can be viewed as recommendations/advice. The guidelines were updated in 2016 by Norwegian Oil and Gas, and the PSA was an observer in this process. The PSA states in an interview that series of audits based on these guidelines were carried out in 2007, 2013 and 2017.[280] According to the PSA, the audits of cyber security for industrial control systems were broad in scope and included several parties. The authority also carried out focus days following the audits in 2013 and 2017 based on the experience gained from the supervision.

According to the PSA, supervision of the area is conducted based on the following industry requirements:

- Framework Regulations Section 10 *Prudent activities*
- Management Regulations Section 4 *Risk reduction*
- Facilities Regulations sections 33 Emergency shut-off system and 34 *Process safety system*

279) In 2013 responsibility for Section 9-3 of the Petroleum Act, Preparedness against deliberate attacks, was delegated to the PSA. Licensees in the petroleum industry must, in accordance with Section 9-3, implement and uphold security measures to prevent deliberate attacks against facilities and platforms, and must always have emergency preparedness plans in place in the event of such attacks, see Ministry of Labour and Social Affairs (2013) *Delegering av myndighet fra Arbeidsdepartementet til Petroleumstilsynet etter lov 29. november 1996 nr. 72 om petroleumsvirksomhet § 9-3* (Norwegian only).

280) Petroleum Safety Authority (2013) *Tilsyn med IKT-sikkerhet i boreprosesskontroll, sikkerhets- og støttesystemer innen petroleumsnæringen* (Norwegian only). Presentation at a seminar on cyber security in the petroleum industry, 27 April.

These regulations were not designed with cyber security in mind, but according to the PSA the regulations give general requirements for security and barriers, which include ICT systems and integrated operations.

Two trade unions are critical of how the authority has upheld its responsibility for cyber security. They state that the technological development of the past 20 years has resulted in ICT systems being connected to technical, logical and organisational industrial automation systems. It has therefore become more demanding to secure barriers that will protect the industrial systems. The cyber security incident at Mongstad illustrates the challenge. The Indian company HCL had access to industrial control systems as a result of work with administrative ICT systems without the company's awareness. Equinor was not sufficiently aware of the connections between administrative and industrial systems, and in practice HCL had access to the industrial security and control systems at Mongstad without having to request prior approval from the company. HCL's tasks were eventually also expanded to include IT firewalls for the facilities and other critical facility-adjacent IT equipment in spite of warnings against this from the company's own employees. The trade unions feel that this is an example of insufficient cyber security that the PSA should have been aware of.

The two trade unions believe that the authority does not follow up cyber security as well as it follows up other key HSE areas. According to the trade unions, the fact that the PSA does not verify that companies are upholding their own cyber security requirements as part of its supervision is a problem. The supervision is carried out in the form of short meetings between the authorities and the companies concerned. The PSA does not go out and ask employees with professional expertise, and therefore does not identify breaches of the regulations. Norwegian Oil and Gas notes that the PSA expends substantial resources on individual topics of supervision without identifying significant nonconformities. As an example of such supervision they refer to audits of cyber security:

- *Audit of Lundin's barrier management in connection with information security for the Edvard Grieg facility,* 23 November 2016.
  Result: no findings.
- *Audit of follow-up of how companies handle ICT security,* 18 May 2017.
  Result: no findings.

The Ministry of Labour and Social Affairs stated in an interview that from a formal perspective, the PSA's responsibility for following up ICT systems is clear. There are some interfaces where the authority faces challenges according to the Ministry, for example with regard to barriers between office suites and process systems. The Ministry of Labour and Social Affairs confirms that there are no specific regulations designed to streamline the implementation of the Petroleum Act Section 9-3 Preparedness against deliberate attacks. The responsibility for this was transferred in 2013 from the Ministry of Petroleum and Energy to the Ministry of Labour and Social Affairs, which further delegated it to the PSA. Licensees in the petroleum industry must, in accordance with Section 9-3, implement and uphold security measures to prevent deliberate attacks against facilities and platforms, and must always have emergency preparedness plans in place in the event of such attacks.[281]

When Section 9-3 was delegated, it was the PSA's assessment that existing regulations covered the contents of this paragraph, and this was seen as sufficient to be able to carry out supervision of the area. According to the PSA, further refinement of Section 9-3 of the Petroleum Act has been postponed pending new security legislation.

281) Ministry of Labour and Social Affairs (2013) *Delegering av myndighet fra Arbeidsdepartementet til Petroleumstilsynet etter lov 29. november 1996 nr. 72 om petroleumsvirksomhet § 9-3* (Norwegian only).

The new Security Act was adopted by the Storting in January 2018, and the work of developing regulations has been ongoing since autumn 2017. The PSA expects the regulations to come to a hearing in 2018.

The Ministry of Labour and Social Affairs has no objection to how the PSA has founded and operationalised its area of responsibility with regard to cyber security. The principles for risk reduction and barrier management in the HSE regulations and guidelines are also applicable in this area.

9.3.4 The PSA's strengthening of work with cyber security

The PSA notes in its annual report for 2017 that several government studies have shown that cyber security in the petroleum industry has not been adequately followed up, and that it is necessary to redouble efforts and follow-up in this area.[282] A recently published report from IRIS on the request of the PSA indicates that the authority is viewed as passive and not very visible in this area.[283]

In autumn 2017 the authority submitted a commitment proposal to the Ministry of Labour and Social Affairs to strengthen supervision in this area in the period 2018–2021. In connection with the consideration of Prop. 1 S (2017–2018) and Innst. 15 S (2017–2018), an application for appropriations was granted to the PSA under chapter 642 for 5.9 MNOK for strengthened follow-up of cyber security in the petroleum sector in 2018, and 11.8 MNOK (including VAT) from 2019 onwards.

The PSA stated in an interview that it has strengthened its competence in the security area by recruiting more staff. As of June 2018 they have seven or eight employees in the security area, of which two have expertise in cyber security. One of the two was hired in 2017. The authority plans to hire one more person, so that there will be three people with expertise in the area.

282) Petroleum Safety Authority (2017) Annual Report 2017.
283) IRIS (2018) *Digitalisering i petroleumsnæringen — Utviklingstrender, kunnskap og forslag til tiltak* (Norwegian only). Report no. 2018/1.

10 Control of the PSA by the Ministry of Labour and Social Affairs

10.1 Management dialogue

The management dialogue consists of agency management meetings as described in *Instruks om virksomhets- og økonomistyring for Petroleumstilsynet* (Instructions for activities and financial management for the Petroleum Safety Authority, Norwegian only). This includes letters of commitment, annual reports, semi-annual reports and agency management meetings, and specialist meetings.[284]

The PSA stated in an interview that the agency management functions well. The State's financial regulations form the basis of the management. The PSA is involved in the creation of the letter of commitment, and the authority has the opportunity to contribute to risk analyses and to describe challenges facing the industry. Agency management meetings are held two or three times per year, with other, more specialised meetings as needed. There is a close dialogue between the PSA's director and the Ministry, in addition to the PSA having ongoing dialogue with the Ministry at management level when it comes to specific matters. The management dialogue has two parts: one concerns finance and the other concerns management by objectives and results (MOR). Financial results are reported in the annual and semi-annual reports.

10.2 Priorities, goals and management parameters

10.2.1 Long-term goals and priorities

The long-term goals and priorities of the PSA's activities were relatively fixed in the period 2014–2018. The main feature of the long-term goals is that the PSA must lay the groundwork for follow-up to ensure that participants in the petroleum industry uphold a high standard of HSE in order to reduce the risk of major accidents, undesirable incidents and work-related injuries and illnesses. Participants in petroleum activities are responsible for ensuring that their activities are carried out in a prudent manner at all times. The primary task of the PSA is to influence, follow up and make it possible for entities to carry out this responsibility. The PSA shall carry out supervision, contribute to the transfer of experience and help to hold participants accountable. In its follow-up the authority must emphasise the development of knowledge and expertise on the part of the participants, regulation development and cooperation between parties. The supervision must also be risk-based. The Ministry also highlights the importance of the PSA being proactive and at the forefront of challenges faced by the petroleum industry, both when it comes to identifying these challenges and how they will be followed up. After the drop in oil prices in the latter half of 2014, the subsequent letter of commitment emphasised that the PSA needed to pay attention to counteracting the fact that streamlining processes in the petroleum industry compromised the level of safety. The Ministry of Labour and Social Affairs emphasises that an important basis for achieving these goals is for the PSA to be a competent and visible entity with the necessary authority and legitimacy.[285]

284) Ministry of Labour and Social Affairs (2018) *Instruks om virksomhets- og økonomistyring for Petroleumstilsynet* (Norwegian only), 24 May 2018.
285) Ministry of Labour and Social Affairs, *Letters of commitment — Petroleum Safety Authority,* 2014–2018.

10.2.2 Goals and management parameters

In accordance with the letter of commitment for 2018, the PSA must support the national objectives for working environment and safety stated in the annual budget proposition. Prop. 1 S for the past four years (2014–2018) describes these objectives:

1. a serious, secure and flexible working environment
2. low risk of major accidents in the petroleum industry
3. development and transmission of new information concerning working conditions, working environment, occupational health and safety

The main objectives of the budget propositions are operationalised as five realisable sub-goals that are repeated in the letters of commitment for the years 2014–2018. These appear in somewhat different formulations, but are largely the same over time:

- The risk of major accidents shall be reduced.
- The working environment shall be safe and serious.
- There shall be a high standard of knowledge regarding HSE as well as security in the petroleum industry.
- Petroleum regulations shall contribute to the achievement of HSE objectives.
- The PSA shall be regarded with confidence and credibility by the public (and act predictably and consistently in its dealings with companies).

There is variation from year to year as to whether the Ministry of Labour and Social Affairs identifies prioritised areas within each sub-goal, and the prioritisations also vary.

The Ministry of Labour and Social Affairs, and subsequently the PSA, was delegated responsibility for the Petroleum Act Section 9-3 Preparedness against deliberate attacks from January 2013. In the letter of commitment for 2015 this was operationalised as a sub-goal, and it was specified that this also includes cyber security. In the letter of commitment for 2017, cyber security is a separate management parameter under the sub-goal concerning deliberate attacks (physical security): *The robustness of ICT systems operational errors and deliberate attacks.*

10.3 Reporting on goals and management parameters

The requirements for reporting the achievement of goals were changed in the period 2014–2018. The letters of commitment for 2014 and 2015 emphasise the reporting of activities and their quantitative representations, for example the number of audits conducted, the number of consents granted or the number of orders issued. Since 2016 the Ministry of Labour and Social Affairs has placed increased attention on its demand that the PSA also report on the *effects* of the activities they have carried out to achieve the objectives of the letter of commitment.

According to the Ministry, it is challenging to identify suitable indicators of the effects of the PSA's work. The management parameters stated in the letters of commitment for 2017 and 2018, and which concern the effects of the authority's work, were developed in cooperation with the PSA and are considered to be appropriate and reasonable. In the opinion of the Ministry of Labour and Social Affairs, these measure the authority's effects with reasonable certainty. The Ministry of Labour and Social Affairs aims to report on the correlation between the effect parameters over time.[286]

The letter of commitment for 2017 states that the Ministry of Labour and Social Affairs will consider the effects of the authority's work in its management. The Ministry states in the

286) Verified minutes from meeting with the Ministry of Labour and Social Affairs, 20 June 2018.

letter of commitment that the PSA must evaluate what effects their efforts have had on participants in the petroleum industry. To form a basis for assessing this, the PSA must observe and measure whether its activities cause the participants to gain increased knowledge, greater awareness and increased motivation, and that they carry out better or more systematic prevention as a result of the authority's activities. The Ministry of Labour and Social Affairs notes that the effects will often appear over time, and that the PSA must therefore view the achievement of goals from a long-term perspective. According to the letter of commitment, the authority must critically evaluate quality in methods of measurement and use of sources as well as validity in data, and in this context they must also assess whether there is a need for external quality assurance.[287]

In the annual report for 2017 the PSA explains how they have worked to fulfil the requirements for reporting and effect assessment. The PSA notes that in their experience, systematic efforts over several years from both the supervisory authorities and the companies themselves produce the greatest effect on the industry's risk level. The PSA states that at the annual status meetings the companies provide feedback as to whether supervision has had an effect in the form of knowledge development and increased awareness within key topics such as barrier management and at-risk groups. The companies also point out information on the PSA's website, particularly audit reports and investigative reports, is used for educational purposes within the companies. The PSA believes that supervisory activities always have the effect that both the authority and the company gain knowledge about nonconformities and improvement points within the topic of the supervision.[288]

The Ministry of Labour and Social Affairs stated in an interview that there is some ambiguity as to what is meant by effective supervision. Is supervision effective when it contributes to knowledge building and guidance about "the Norwegian model" for follow-up of HSE in the petroleum industry, or when strict audits are conducted with many nonconformities and verifications? The Ministry of Labour and Social Affairs states that they, in collaboration with other supervisory authorities and ministries in other countries, are striving to strike a good balance on this issue. In addition, the Ministry of Labour and Social Affairs has asked the PSA to conduct discussions and collaboration with other supervisory authorities on the same topics.[289]

Reporting of results and effects

The Ministry of Labour and Social Affairs has set some overarching management parameters that will help to provide information about the effects of the PSA's work on the state of HSE in individual companies and in the petroleum industry as a whole. According to the Ministry of Labour and Social Affairs, it is challenging to identify good indicators of the effects of supervisory activities on the industry's risk level. This is because supervisory activities will only have an indirect effect on the companies' HSE performance. The parameters stated in the letter of commitment were developed in collaboration with the PSA and are considered to be appropriate and reasonable. The Ministry of Labour and Social Affairs aims to report on the correlation between effect parameters over time.

287) Ministry of Labour and Social Affairs (2017), *Letter of commitment — Petroleum Safety Authority 2017*.
288) Petroleum Safety Authority (2018) Annual Report 2017.
289) Verified minutes from meeting with the Ministry of Labour and Social Affairs, 20 June 2018.

The Ministry of Labour and Social Affairs notes that Engen 1,[290] and later Engen 2[291] support the current HSE regime. The Ministry of Labour and Social Affairs finds that among the relevant parties there is great confidence that the current model for follow-up of HSE in the petroleum industry is suitable. The Ministry emphasises that there is no documentation of what type of supervision is most effective, but that there have been good experiences with the current regime. The trust-based supervision was developed following the Kielland accident, and figures from RNNP indicate that the safety level on the Norwegian continental shelf has shown positive development since 2000. This regime is also rooted in a united Storting, most recently in connection with the consideration of the white paper on HSE in the petroleum industry on the Norwegian continental shelf in spring 2018.

The Ministry of Labour and Social Affairs notes that in the letter of commitment for 2018 they expressed that the PSA must be proactive and actively assess the use of sanctions and responses based on need and what will produce optimal results, and that the authority is the most competent entity to assess the need for this.

10.4 Appropriations

In the letter of commitment, the Ministry provides the financial framework for the PSA and states priorities, objectives and reporting requirements. The letter of commitment governs the PSA's activities and establishes which areas will have highest priority.[292] The PSA is entitled to impose penalties and sector fees for expenses incurred in connection with supervision and other follow-up of the petroleum industry.[293] The size of the penalties and fees is set through the budget proceedings and is communicated to the PSA through the annual letter of commitment. The proportion of the PSA's operating expenses covered by revenue increased from 50 per cent in 2013 to 62 per cent in 2018.

Norwegian Oil and Gas and the Norwegian Shipowners' Association state that they feel the revenue requirement places constraints on the authority. Norwegian Oil and Gas stated in an interview that they feel there is some repeated supervision of topics or facilities with no particular nonconformities or unique risk factors. According to Norwegian Oil and Gas, the companies mainly express that the PSA is a professional supervisory body. Nevertheless, several companies express that they feel the amount of supervision is at times too great. According to Norwegian Oil and Gas, the PSA often expends substantial resources on individual topics of supervision without identifying significant nonconformities. According to Norwegian Oil and Gas, supervision of change management is an example of this, as are the two audits of information security and cyber security in 2016 and 2017. The supervisory activities also demand significant resources from the companies.

The PSA stated in an interview that it would not be able to charge more in penalties or sector fees than the costs incurred during follow-up activities. The revenue from

290) In 2012 the Ministry of Labour and Social Affairs appointed an expert group to conduct a review of supervision strategy and HSE regulations. The expert group submitted its report in 2013: Ministry of Labour and Social Affairs (2013) *Tilsynsstrategi og HMS-regelverk i norsk petroleumsvirksomhet* (Norwegian only).

291) In 2012 the Ministry of Labour and Social Affairs appointed a multipartite group to carry out a joint assessment and discussion of the state and development of HSE in the Norwegian petroleum industry. The group submitted its report in autumn 2017: Ministry of Labour and Social Affairs (2017) *Health, safety and working environment conditions and trends in the Norwegian petroleum industry*.

292) Ministry of Labour and Social Affairs, *Letter of commitment — Petroleum Safety Authority*, letters of commitment from the period 2014–2017.

293) *Ordinance concerning the right to impose fees and sectoral fee for supervision and other follow-up of safety and environment within petroleum activities,* 8 January 2013.

penalties and sector fees is paid to the Treasury so that the PSA does not base its responses and supervisory activities on revenue. This means that the PSA does not have the ability to obtain its own revenue or to adapt its operational or strategic work based on this.[294]

The PSA feels it could have carried out many more supervisory activities, but it must make strict risk-based prioritisations based on the available resources. The authority prioritises the most important tasks based on assessments of risks and professional challenges. The PSA does not feel that the revenue requirement places constraints on the professional activity. The revenue requirement is set by the Ministry of Labour and Social Affairs. Revenue requirements are not imposed on individual employees, as there are periods in which individual employees are highly involved in other activities, such as regulatory work, standardisation or studies for the Ministry. The management follows up to ensure that the revenue requirement is met.[295]

10.5 Evaluation and independent investigative committee

In autumn 2017, the Ministry of Labour and Social Affairs appointed a working group with representatives from the industry and authorities (Engen 2) to discuss audit problems connected to HSE in the petroleum industry. The working group's recommendation is an input to Report to the Storting 12 (2017–2018) *Health, safety and environment in the petroleum industry*.

The Ministry of Labour and Social Affairs notes that the PSA's role and work is evaluated through Report to the Storting 12 (2017–2018), through the Engen committees in 2013 and 2017, and in an external evaluation from 2007. These evaluations concluded that the current model for follow-up of HSE in the petroleum industry has had a positive effect on the sector's risk level, and that it should be continued.[296] The Ministry of Labour and Social Affairs states that an educational project was initiated within the PSA to identify learning points from development projects in recent years.

The Ministry of Labour and Social Affairs has the right to appoint an independent investigative committee. Section 10-10 of the Petroleum Act contains the legal basis and first-order criteria for establishing an investigative committee. The terms for appointing such a committee require that a serious accident or incident has occurred that has resulted in a serious risk of loss of life, substantial material damages or the pollution of the marine environment. According to the Ministry of Labour and Social Affairs, this makes it possible to appoint an investigative committee both in the event of actual accidents and in the event of near-accidents with the potential for serious consequences. According to the Ministry, an investigative committee has been appointed four times since the beginning of the petroleum industry:

- The Bravo blowout in 1977
- The Alexander Kielland accident in 1980
- The diving accident on Byford Dolphin in 1983
- The West Vanguard blowout in 1985

The PSA does not evaluate its own role in its investigations and focuses primarily on the companies' role. An independent investigative committee appointed by the Ministry

294) Report to the Storting 12 (2017–2018) *Health, safety and environment in the petroleum industry.*
295) Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.
296) Verified minutes from meeting with the Ministry of Labour and Social Affairs, 20 June 2018.

of Labour and Social Affairs could evaluate the PSA's role and follow-up of the companies prior to the incidents.

According to Odelsting proposition no. 72 (1982–1983), work accidents that result in serious personal injury or death will normally not be grounds to establish an ad hoc independent investigative committee. The Ministry of Labour and Social Affairs therefore believes that the fatal accident on Maersk Interceptor in 2017 does not fulfil the requirements for such an investigation. The fatal accident on Cosl Innovator in 2015 could, according the Ministry of Labour and Social Affairs, possibly have been investigated, particularly in light of the potential for harm and the aftermath of the incident. The Ministry of Labour and Social Affairs states that independent investigative committees have not been used in recent times, and that the tendency until now has been that these should be used in the event of very serious accidents that are large in scope. The Ministry states that there has been pressure from the workers' side to establish a permanent independent investigative committee. However, the Ministry states that in the case of major accidents, such as the Alexander Kielland accident, a public committee will be appointed instead.

In 2010 the Ministry of Labour and Social Affairs signed an agreement with the Accident Investigation Board of Norway. The agreement entails an opportunity for administrative support and access to methodology should an investigative committee be established. According to the Ministry, the Accident Investigation Board will not assist in the actual investigation work. This agreement is currently under renegotiation (as of June 2018) according to the Ministry. In the spring of 2018 the Ministry of Labour and Social Affairs arranged a meeting with the Accident Investigation Board in order to renew the agreement. Both parties have clarified that an agreement for renewal can be made without the need for major changes.

11 Judgements

11.1 In the cases that have been investigated, the PSA's supervisory practices had a limited impact on the companies' follow-up of health, safety and environment issues

The investigation covers the PSA's supervision of the companies, use of sanctions, follow-up of events and reporting of concerns, granting of consent and acknowledgements of compliance (AoCs), and control of the PSA by the Ministry of Labour and Social Affairs. The investigation builds upon a broad overview of the PSA's supervisory practices, based on, among other things, case studies of four installations/ onshore production facilities, interviews, documents, supervision data, incident reporting and reports of concern. The case studies examine the PSA's follow-up of the Goliat production facility, the incident on Songa Endurance in autumn 2016, the incidents at the Mongstad onshore production facility in 2014 and 2016, and on the Nyhamna onshore production facility. The four case studies were selected based on the associated high risk and significance.

The PSA must lay the groundwork for and follow up to ensure that participants in the petroleum industry maintain a high standard of health, safety, environment and preparedness, in accordance with Crown Prince's resolution of 19/12/2003. As with other sectors of industry, there are certain entities that are responsible for HSE standards. The PSA's follow-up investigations must be system-oriented and risk-based, and must be performed in addition to each company's own follow-up work. Implementing system-based supervision ensures that it is directed towards relevant parts of a company's management systems and any subsequent verifications. Implementing risk-based supervision ensures that it is directed towards issues and activities in which HSE is most challenging and critical, and towards situations that could present a risk of unwanted incidents or conditions, and where the PSA's efforts are likely to have the greatest effect with regard to identifying any failures on the part of the companies to take responsibility for proper operation.[297] The supervisory activities are prioritised based on comprehensive assessments of where the risk is highest, and the method of supervision is adapted to the risk and the object of the audit.[298]

Overall, authorities and industry players are of the opinion that the current HSE policy is robust and well-functioning with a high level of safety. They also trust that the current system- and risk-based model for following up on HSE in petroleum activities is well suited to the task.[299] However, the investigation shows that there are significant challenges in certain areas. Despite close follow-up from the PSA, investigations, notices regarding breaches of regulations and the use of sanctions and other responses, in several instances the companies have failed to prioritise the rectification of regulatory nonconformities:

- The case study of Goliat demonstrates that the PSA's repeated documentation of nonconformities in the areas of logistics, working environment and ignition source control in the period 2012–2017 had a limited impact on the company's safety efforts. Eni failed to rectify significant regulatory nonconformities within a reasonable length of time.

297) Report to the Storting 12 (2017–2018) *Health, safety and environment in the petroleum industry*.
298) Petroleum Safety Authority (2017) *Risikobasert tilsyn i hovedgruppene* (Norwegian only). Internal guidelines, last revised 2 May 2017.
299) Report to the Storting Report to the Storting 12 (2017–2018) *Health, safety and environment in the petroleum industry*.

- The case study of the Songa Endurance incident shows that the PSA repeatedly ordered Equinor to ensure that they took lessons from serious incidents. The underlying causes of the incidents were essentially the same. The audit's judgement is that the PSA did not perform sufficient follow-up to ensure that Equinor did in fact learn from previous serious incidents. Equinor's own investigation of the incident in 2016 found that financial concerns took precedence over regard for safety. which played a key part in the incident occurring.
- The case study of the gas leak at Mongstad shows that, in the period 2010–2012, the PSA identified several nonconformities relating to maintenance regulations in the course of its supervisory activities and investigations. Equinor's investigation of the 2016 gas leak shows that the company did not follow up on all the nonconformities that the PSA identified. Cuts to appropriations for maintenance work, in combination with the failure to follow up on regulatory nonconformities, contributed to the serious incident in 2016. The PSA held too much trust that Equinor would rectify the regulatory breaches of its own accord.
- The case study of the cyber security incident at Mongstad in 2014 shows that the PSA's follow-up on Equinor's cyber security had little impact. The investigation shows that Equinor was facing cyber security challenges that the PSA failed to identify.

The case studies contain several examples demonstrating that the PSA's supervisory practices have a limited impact on how the companies handle their responsibility for health, safety and environment. The case studies show that, in several instances, the companies did not follow up on orders or notices of regulatory nonconformities. Three of the four case studies involve the PSA's follow-up of Equinor, either directly as an operator or indirectly as a licensee. The investigation shows that the trust-based model for following up on petroleum activities creates challenges for the PSA when companies do not take the notices from the supervisory authority seriously. Equinor is responsible for over 70 per cent of all petroleum activity in Norway, and it is troubling that even this company does not follow up on notices from the PSA.

11.1.1 Individual instances show that the PSA's methods of supervision do not contribute to the detection of serious safety concerns

One of the PSA's key tools for checking that companies are complying with the regulations is supervision in the form of audits and verifications.[300] The case studies show that the PSA carries out audits and verifications, and reveals breaches of the regulations. However, the case studies also show that serious incidents occur as a result of regulatory nonconformities that the PSA could have discovered if it had, to a greater extent, adapted its supervisory methods to the risks. At Mongstad there were many indications that Equinor was facing challenges concerning the maintenance of the facility.

The PSA had knowledge of the facility's recurring gas leaks, some of which were serious, and significant maintenance backlog. Nevertheless, in its supervision of maintenance at Mongstad in 2016, the PSA chose to carry out a system audit without verification of the actual conditions at the facility. Afterwards, the investigation of the incident found that several regulatory breaches contributed directly to the serious gas leak incident later that year. Admittedly, Equinor's own investigation of the incident shows that the company had more knowledge of the problems than the PSA was informed of in the supervision carried out in 2016. The audit finds that the PSA could have done more to control the actual situation at the facility.

300) Audits are planned, systematic investigations into parts of a company's management system. Verifications are physical, on-site investigations in connection with supervision with the purpose of ascertaining whether the factual conditions are in alignment with the regulations.

Correspondingly, the case studies of Goliat and the cyber security incident at Mongstad show that the PSA had information about and indications of safety concerns, but chose to trust that the companies had these situations under control. This was the case with regard to ignition source control at Goliat and cyber security within Equinor. The PSA failed to carry out verifications that Eni and Equinor's plans, measures and procedures were put into practice. The Office of the Auditor General finds that, in these cases, the PSA put too much trust in the companies. The probability that the PSA would have discovered significant safety concerns would have been greater if they had chosen supervisory methods that took into account risk and significance in their follow-up. The PSA did not to a sufficient extent conduct verifications based on available information about risks and challenges.

11.1.2 The companies do not always rectify regulatory nonconformities following notification, and the PSA does not always perform sufficient follow-up to ensure that nonconformities are rectified

When the Petroleum Safety Authority discovers regulatory breaches in the course of its supervision, it expects the companies to rectify these breaches within a given time period, in accordance with a plan that the companies are normally ordered to send in. The case studies of Goliat and Mongstad show that the companies report in writing that regulatory breaches have been rectified when this is in fact not the case. In the PSA's experience, measures to rectify identified nonconformities or improvement points can be assigned a lower priority relative to a company's internal budget processes. The case studies of Goliat and Mongstad show that, in some instances, the companies do not inform the PSA of the true HSE situation during supervision. The Office of the Auditor General believes that the PSA does not to a sufficient extent verify that oral and written feedback from the companies is in line with reality. Consequently, the companies may not rectify regulatory breaches, which in turn increases the risk of incidents.

In 2017 and 2018 the PSA escalated its follow-up of previously identified regulatory breaches. However, the case studies show that this type of follow-up was first implemented only after serious incidents occurred or as a result of reports of concern. For example, the PSA followed up on and verified the planning and execution of Equinor's drilling activities after the Songa Endurance incident. The same was done following the gas leak at Mongstad in 2016.

The supervisory authority also verified that Eni had complied with the order to cease production at Goliat, which was issued due to serious nonconformities in the electrical system, before Eni was permitted to resume production. The supervisory activities that prompted the order to cease production were based on a report of concern regarding the electrical system at Goliat from September 2017. The Office of the Auditor General takes a positive view of the fact that the PSA escalated its follow-up of prior regulatory breaches. However, the case studies indicate that, on the other hand, the PSA relies too heavily on meetings and written statements from companies in its evaluations of how regulatory breaches have been followed up on. The investigation shows that, in several cases, the PSA fails to verify that oral and written feedback from the companies is in alignment with reality.

11.1.3 The PSA is slow to implement strict sanctions when these are needed, and does not do a sufficiently thorough job of investigating whether companies have complied with orders

The PSA has several legal responses at its disposal in the event that it uncovers breaches of the regulations. These legal responses include orders, coercive fines, suspension of operations and penalties for violation. The use of sanctions must be

reflective of the materiality and significance of the regulatory breach in question. Additionally, the PSA is entitled to report cases to the police.

The PSA rarely uses sanctions more severe than the issuance of orders. The PSA finds orders to be a very effective tool, and typically the most effective means of influencing companies to rectify any nonconformities. This appears to be a reasonable premise when the PSA can trust that companies will take their responsibility seriously and comply with the regulations. The investigation also shows that the PSA issues orders in cases containing findings that they judge to be serious. The PSA therefore seldom uses the other responses at its disposal, and has only used suspension of operations once in the period under investigation. The responses of coercive fines and penalties for violation have never been used.

The case study of Goliat shows that the PSA is overly hesitant to impose strict sanctions. The same serious nonconformities were revealed in repeated supervisory activities over several years, yet the PSA did not escalate its use of sanctions. Only in autumn 2017, after the platform had been in service for a year and a half, did the PSA order Eni to suspend operations. This was after the authority had once again discovered insufficient control of ignition sources. Control of ignition sources was also a requirement for the PSA's consent to begin using the facility, which was granted in January 2016. The company claimed that the serious regulatory breaches had been rectified, when in reality they had not. The PSA's hesitancy to escalate the use of sanctions meant that work on Goliat was begun without sufficient control of ignition sources. An audit established that the PSA did not employ the sanctions at its disposal against the company when this was needed. Consequently, this could mean that nonconformities are not rectified in time and that the risk of serious incidents increases.

The case study of the Songa Endurance incident shows that orders issued after serious incidents in which Equinor was the operator did not have a sufficient impact. Five serious incidents that occurred in the period 2004–2016 have many of the same underlying causes. The PSA drew attention to these causes in prior supervisory work and investigations, and Equinor was ordered to address them. In the orders issued after the incidents on Gullfaks C in 2010, at Heimdal in 2012 and on Songa Endurance in 2016, the authority stated that Equinor must evaluate why previous measures implemented after earlier incidents had not been effective. The PSA did not perform sufficient follow-up on orders issued following previous serious incidents. Even after the last incident in 2016, there are indications that Equinor did not follow up on the orders. An audit established that the PSA puts too much trust in the plans and measures that companies present to comply with orders, and does not do enough to confirm that these plans and measures are in agreement with the facts. This could result in Equinor not implementing necessary plans and measures, which thereby does not reduce the risk of new, serious well-control incidents or gas leaks where Equinor is the operator.

11.2 In general, the PSA does a good job of following up incidents and reports of concern

Serious incidents that have or could have resulted in death, serious injury, acute life-threatening illness, the impairment of safety-related barriers that could have put the facility at risk, and/or acute contamination must be reported to the PSA by the

operator[301] The PSA is obliged to follow up on the incidents and to supervise or investigate depending on the degree of severity.

The case studies of Goliat, the Songa Endurance incident, Nyhamna and Mongstad, as well as the general review of how incidents are treated show that, in most cases, the PSA follows up on incidents that are reported by the companies involved. The authority appears to have good systems for receiving and recording incident reports, and follow-up on the incidents is traceable through the authority's case processing systems. The operators are ordered to report incidents to the PSA within given deadlines. However, there are examples where companies have, for various reasons, failed to report incidents.

In recent years the PSA has noted several failures to report incidents in the course of its supervisory work, but the authority does not have the impression that under-reporting is a widespread problem.

The PSA must follow up on and process reports of troubling conditions in accordance with applicable law and with the authority's own procedures. The investigation shows that, in most cases, the PSA's follow-up on reports of concern is in line with the requirements set forth for follow-up. The review shows that documentation of case processing in the PSA's archive system is, to some extent, lacking. In many instances the PSA's follow-up is insufficiently documented, even when the cases have been processed correctly according to the authority's procedures. Because the follow-up on reports of concern is not uniformly and comprehensively recorded and documented, the official information regarding the processing of cases is not complete.

11.3 The PSA granted consent for the commissioning of Goliat despite the fact that the safety of the platform had not yet been properly guaranteed

The PSA must grant consent to commission a facility when it trusts that the operator can run the facility in accordance with applicable laws and regulations. Consent is granted following an application submitted by the operator and is based on said application as well as the PSA's previous supervision, meetings and experience with the operator.

The investigation shows that the PSA demonstrated too much trust that Eni would ensure Goliat was ready before operations began at the facility. The authority was aware that Eni did not have a complete overview of what had been done and what work was still outstanding, due to misclassifications in the company's management system. The PSA therefore did not have reliable information regarding the remaining work to be done on Goliat at the time when it granted consent. Eni was granted consent to commission Goliat on the condition that Eni and Equinor could document that specific requirements had been fulfilled, and that the planned work of completing the platform was carried out. The PSA did not request documentation of this, aside from a meeting in which the companies presented what had been done and what of the planned work was still outstanding. Additionally, the PSA did not carry out verification as to whether the requirements for consent had been fulfilled, nor whether the planned work had in fact been carried out.

The PSA involved Equinor as a licensee to review and verify that Eni had taken the necessary actions to be able to start operations at Goliat. After its review, Equinor

301) Management Regulations, section 29.

prepared a report that contained several critical findings, including the fact that there was great uncertainty regarding what work was still required to ensure control of ignition sources. The report was made available after the consent had been granted, and showed that much work was still required before the requirements of the consent were fulfilled. The PSA did not request Equinor's report and did not verify that Eni handled the findings in a satisfactory manner. Although the PSA demanded that Eni document that all safety systems, including the ignition source control system, were tested and in working order, the authority chose to trust Eni and Equinor's assessments that Goliat was ready for operation, without requesting documentation or verifying that the safety systems were indeed in working order.

The results of Equinor's review, the supervision of electrical and ignition sources in 2017 and the order that the PSA gave Eni in January 2017 to go through all the plans for commissioning work all substantiate the finding that the consent to commission Goliat was granted with too much trust that Eni would be able to handle the complex work that remained to be done. The assessment of the audit was that previous experiences with the company indicate that the PSA should have ensured that the work that remained before Goliat was ready for commissioning was indeed completed before it granted consent to commission the facility.

11.4 The Ministry of Labour and Social Affairs does not obtain relevant information about the effectiveness of the PSA, nor does it investigate whether the PSA takes sufficient responsibility for cyber security

The Ministry of Labour and Social Affairs will set overarching goals, management parameters and reporting requirements for the PSA, and will carry out duties of management, follow-up and control to determine whether the authority achieves the goals that have been set.

Through the letter of commitment, the Ministry of Labour and Social Affairs requires the PSA to report on the effects that the authority's efforts have on industry players. Letters of commitment provide guidelines for how this should be measured and evaluated. The management parameters that should measure effect are increased awareness, increased motivation and increased prevention on the part of the participants. In recent years the measurement of effect has been based on the companies' qualitative feedback to the PSA at annual meetings. The question is whether the companies are interested in providing feedback that the supervision does not result in increased awareness or motivation, or that it does not contribute to prevention, even if this is the case. The audit results suggest that qualitative feedback from the companies does not provide adequate information about the authority's effectiveness.

In recent years the Ministry of Labour and Social Affairs has appointed joint committees that have evaluated the authority's follow-up on petroleum activities. The Ministry of Labour and Social Affairs has the right to appoint an independent investigative committee; see Section 10-10 of the Petroleum Act. The terms for appointing such a committee require that a serious accident or incident has occurred that has resulted in a serious risk of loss of life, substantial material damages or the pollution of the marine environment.

The Ministry has not exercised the right to appoint an independent investigative committee since the West Vanguard blowout in 1985. There have been no major accidents in petroleum activities within the PSA's area of responsibility since 1985. There have, however, been numerous fatal accidents and many serious incidents that

had the potential to become major accidents. If an independent investigative committee had been appointed, it could have provided useful information about how the PSA follows up on companies prior to serious incidents. The Office of the Auditor General finds it reprehensible that the Ministry of Labour and Social Affairs did not secure accurate and relevant information about the effect of the PSA's supervisory activities on the HSE work of the companies involved. Without accurate information about the effect of the PSA's work, it is difficult for the Ministry to evaluate whether the authority is making the most effective use of resources.

The Ministry of Labour and Social Affairs was given responsibility for Section 9-3 of the Petroleum Act *Emergency preparedness against deliberate attacks* in 2013 and delegated this responsibility to the PSA the same year. However, the Ministry did not formulate this as a goal in a letter of commitment to the PSA in 2015. In 2017 it was specified that the goal should also apply to the ability of ICT systems to withstand operational errors, after it came to light in 2016 that Equinor had been affected by several incidents because the ICT systems did not have adequate protection. The PSA has not specified which requirements for cyber security are implicated by Section 9-3 of the Petroleum Act because the authority believes that the requirements for licensees regarding emergency preparedness against deliberate attacks are covered by existing regulations. According to the PSA, further refinement of Section 9-3 of the Petroleum Act has been postponed pending new security legislation. ICT is used in all stages of petroleum activity, and if companies fail to protect cyber security, this can result in risks to health, safety and environment. The Office of the Auditor General finds that the Ministry has not performed adequate follow-up of how the PSA handles its responsibility for cyber security as stated in Section 9-3 of the Petroleum Act.

12 List of references

Storting proposals and white papers

- Prop. 1 S (2017–2018) *Ministry of Labour and Social Affairs.*
- Prop. 1 S (2016-2017) *Ministry of Labour and Social Affairs*.
- Prop. 1 S (2016–2017) *Ministry of Petroleum and Energy.*
- Prop. 97 S (2012–2013) *Utbygging og drift av Aasta Hansteen-feltet og anlegg og drift av Polarled utviklingsprosjekt og Kristin gasseksportprosjekt* (Norwegian only).
- Odelsting proposition no. 72 (1982–1983) *Act relating to petroleum activities.*
- Report to the Storting 12 (2017–2018) *Health, safety and environment in the petroleum industry.*
- Report to the Storting 2 (2017–2018) *Revised National Budget 2018.*
- Report to the Storting 29 (2010–2011) *Joint responsibility for a good and decent working life.*
- Proposition to the Storting no. 64 (2008–2009) *Utbygging og drift av Goliatfeltet (Norwegian only).*
- Report to the Storting no. 17 (2002–2003) *Om statlige tilsyn* (Norwegian only).
- Report to the Storting no. 12 (2005-2006) *Health, safety and environment in the petroleum industry.*

Recommendations to the Storting

- Innst. 385 S (2017–2018) *Innstilling fra arbeids- og sosialkomiteen om helse, miljø og sikkerhet i petroleumsvirksomheten* (Norwegian only).
- Innst. 15 S (2016–2017) *Innstilling fra arbeids- og sosialkomiteen om bevilgninger på statsbudsjettet for 2017* (Norwegian only).
- Innst. 333 S (2011–2012)
- Innst. S. nr. 363 (2008–2009) *Innstilling fra energi- og miljøkomiteen om utbygging og drift av Goliat-feltet* (Norwegian only).
- Innst. S. nr. 197 (2005–2006) *Innstilling fra arbeids- og sosialkomiteen om helse, miljø og sikkerhet i petroleumsvirksomheten* (Norwegian only).
- Innst. S. nr. 222 (2002–2003) *Innstilling fra familie-, kultur- og administrasjonskomiteen om statlige tilsyn* (Norwegian only).

Acts

- *Act relating to petroleum activities* (Petroleum Act).
- *Act relating to procedure in cases concerning the public administration* (Public Administration Act).
- *Act relating to working environment, working hours and employment protection, etc.* (Working Environment Act).

Ordinances and guidelines

- *Ordinance concerning the right to impose fees and sectoral fee for supervision and other follow-up of safety and environment within petroleum activities.*
- *Regulations relating to health, safety and the environment in the petroleum activities and at certain onshore facilities* (Framework Regulations) (Norwegian only).
- *Regulations relating to management and the duty to provide information in the petroleum activities and at certain onshore facilities* (Management Regulations).
- *Regulations relating to conducting petroleum activities* (Activities Regulations).
- *Regulations relating to design and outfitting of facilities, etc. in the petroleum activities* (Facilities Regulations).
- *Regulations relating to technical and operational matters at onshore facilities in the petroleum activities, etc.* (Technical and Operational Regulations).

Instructions

- *Vedtak om opprettelse av Petroleumstilsynet* (Norwegian only), see Crown Prince's resolution of 19 December 2003.
- *Ministry of Labour and Social Affairs (2018) Instruks om virksomhets- og økonomistyring for Petroleumstilsynet (Norwegian only),* 24 May 2018

Other regulations and guidelines

- *Regulations on Financial Management in Central Government.*
- *Provisions on Financial Management in Central Government.*

Other documentation from the Ministry of Labour and Social Affairs

- *Ministry of Labour and Social Affairs (2013) Delegering av myndighet fra Arbeidsdepartementet til Petroleumstilsynet etter lov 29. november 1996 nr. 72 om petroleumsvirksomhet § 9-3* (Norwegian only).

Letter of commitment

- Ministry of Labour and Social Affairs, *Letters of commitment — Petroleum Safety Authority*, 2014–2018.

Audit reports and investigations carried out by the PSA

- Petroleum Safety Authority (2018) *Mongstad refinery — Naphtha leak in cracker, 24 October 2017*, 19 February.
- Petroleum Safety Authority (2017) *Tilsynet med Statoil og Songa Offshores planlegging og gjennomføring av bore/ brønnoperasjoner på Troll* (Norwegian only), 13 November.
- Petroleum Safety Authority (2017) *Rapport etter tilsyn med Eni Norge om elsikkerhet og ansvarshavende for de elektriske anleggene Goliat FPSO* (Norwegian only), 31 October.
- Petroleum Safety Authority (2017) *Tilsyn med Statoil — Mongstad* (Norwegian only), 21 March.
- Petroleum Safety Authority (2017) *Gas leak at Statoil Mongstad on 25 October 2016*, 6 March.
- Petroleum Safety Authority (2017) Report of the investigation of the well control incident in well 31/2-G-4 BY1H/BY2H on the Troll field with the Songa Endurance drilling unit, 21 February.
- Petroleum Safety Authority (2017) *Statoil sin håndtering av hendelser knyttet til IKT og informasjonssikkerhet, og tilhørende barrierestyring* (Norwegian only). Audit report, 30 January.
- Petroleum Safety Authority (2017) *Investigation report — Goliat FPSO — serious personal injury 250616*, 19 January.
- Petroleum Safety Authority (2017) *Audit report — management of the working environment and employee participation Goliat*, 6 January.
- Petroleum Safety Authority (2016) *Rapport etter tilsyn med Nyhamna — Oppfølging av funn fra tidligere tilsyn innen arbeidsmiljø og løfteoperasjoner* (Norwegian only), 17 March.
- Petroleum Safety Authority (2016) *Tilsyn med overflatevedlikehold og korrosjon under isolasjon hos Statoil Mongstad* (Norwegian only), 9 February.
- Petroleum Safety Authority (2016) *Nyhamna — Investigation following incidents with falling objects*, 28 January.
- Petroleum Safety Authority (2016) *Oppfølging av tilsyn innen logistikk, med tillegg av arbeidstakermedvirkning Goliat* (Norwegian only), 7 January.
- Petroleum Safety Authority (2015) *Tilsyn med elektriske anlegg på Goliat FPSO* (Norwegian only), 11 September.
- Petroleum Safety Authority (2015) *Tilsyn med forberedelse til drift innenfor logistikk Goliat FPSO* (Norwegian only), 18 June.

- Petroleum Safety Authority (2015) *Rapport etter tilsyn med Nyhamna om styring av sikkerhet og arbeidsmiljø, vedlikehold og kontroll av stillastutstyr* (Norwegian only), 26 May.
- Petroleum Safety Authority (2015) *Rapport etter tilsyn med styring av arbeidsmiljø og materialhåndtering under utbyggingen ved Nyhamna* (Norwegian only), 15 January.
- Petroleum Safety Authority (2014) *Rapport etter tilsyn med styring av arbeidsmiljø i ferdigstillelsesfasen av Goliat-prosjektet* (Norwegian only), 23 June.
- Petroleum Safety Authority (2014) *Tilsyn med tekniske og operasjonelle barrierer på Goliat FPSO* (Norwegian only), 14 March.
- Petroleum Safety Authority (2014) *Rapport etter tilsyn med materialhåndtering Goliat* (Norwegian only), 14 February.
- Petroleum Safety Authority (2014) *Tilsyn med materialhåndtering Goliat FPSO* (Norwegian only), 23 January.
- Petroleum Safety Authority (2013) *Rapport etter tilsyn med G4S Nyhamna på arbeidsmiljø og beredskap* (Norwegian only), 11 September.
- Petroleum Safety Authority (2013) *Rapport etter tilsyn med tekniske og operasjonelle barrierer på Goliat FPSO* (Norwegian only), 11 June.
- Petroleum Safety Authority (2013) *Tilsyn med IKT-sikkerhet i boreprosesskontroll, sikkerhets- og støttesystemer innen petroleumsnæringen* (Norwegian only). Presentation at a seminar on cyber security in the petroleum industry, 27 April.
- Petroleum Safety Authority (2013) *Tilsyn med tekniske og operasjonelle barrierer på Goliat FPSO* (Norwegian only), 24 April.
- Petroleum Safety Authority (2013) *Rapport etter tilsyn med driftsforberedelser for Goliat FPSO* (Norwegian only), 13 March.
- Petroleum Safety Authority (2013) *Granskingsrapport — Damplekkasje på Mongstad 8.11.2012* (Norwegian only), 8 March.
- Petroleum Safety Authority (2012) *Report from the investigation of a hydrocarbon leak on Heimdal, 26 May 2012*, 20 December.
- Petroleum Safety Authority (2012) *Tilsyn med materialhåndtering og arbeidsmiljø Goliat FPSO* (Norwegian only), 3 September.
- Petroleum Safety Authority (2012) *Tilsyn med tekniske og operasjonelle barrierer på Goliat FPSO* (Norwegian only), 25 April.
- Petroleum Safety Authority (2012) *Rapport etter tilsyn med design av Goliat — materialhåndtering og arbeidsmiljø* (Norwegian only), 20 April.
- Petroleum Safety Authority (2012) *Tilsyn med tekniske og operasjonelle barrierer på Goliat FPSO* (Norwegian only), 23 March.
- Petroleum Safety Authority (2011) *Rapport etter tilsyn med ivaretakelse av arbeidsmiljø, materialhåndtering og beredskap i design av Goliat* (Norwegian only), 22 June.
- Petroleum Safety Authority (2011) *Rapport etter tilsyn med helhetlig kjemikaliestyring Nyhamna* (Norwegian only), 25 March.
- Petroleum Safety Authority (2011) *Gas leak on Gullfaks B 4 December 2010*, 11 March.
- Petroleum Safety Authority (2010) *Investigative report — Gas leak at Mongstad 8 February 2010*, 22 March.
- Petroleum Safety Authority (2010) *Audit of Statoil's planning for well 34/10-C-06A*, no date.
- Petroleum Safety Authority (2005) *Gransking av gassutblåsing på Snorre A, brønn 34/7-P31 A 28.11.2004* (Norwegian only), no date.

Other documentation from the PSA

- Petroleum Safety Authority (2017) *Goliat historien — internal presentation* (Norwegian only), internal document received by email 7 July.

Annual reports
- Petroleum Safety Authority (2017) Annual Report 2016.
- Petroleum Safety Authority (2018) Annual Report 2017.

Letters and emails
- Petroleum Safety Authority (2018) *Våre kommentarer til utkast til rapport fra Riksrevisjonen*, Appendix 2 (Norwegian only), letter with appendix 16 October 2018.
- Petroleum Safety Authority (2018) *Skriftlig svar på spørsmål fra sluttintervju* (Norwegian only). Email to the Office of the Auditor General, 18 June.
- Songa Offshore/Statoil (2018) *Tilbakemelding på tilsynsrapport — Statoil og Songa Offshore sin planlegging og gjennomføring av bore-/brønnoperasjoner på Troll* (Norwegian only). Letter to the Petroleum Safety Authority, 15 January.
- Petroleum Safety Authority (2017) *Tema store satsinger 2018 — IKT-sikkerhet* (Norwegian only), letter to the Ministry of Labour and Social Affairs, 15 December.
- Petroleum Safety Authority (2016) *Varsel om pålegg etter tilsyn med Heimdal hovudplattform og stigerøyrsplattform — drift, vedlikehald og trykksikringssystem* (Norwegian only), letter to Statoil, 25 November.
- Petroleum Safety Authority (2017) *Pålegg etter tilsyn med Eni Norge om elsikkerhet og ansvarshavende for de elektriske anlegg* (Norwegian only). Letter to Eni Norge AS, 13 November.
- Petroleum Safety Authority (2017) *Order to Eni Norge — electrical safety and person in charge of electrical facilities.* Letter to Eni Norge AS, 6 October.
- Petroleum Safety Authority (2017) *Varsel om tilsyn med planlegging og gjennomføring av bore- og brønnoperasjoner på Songa Endurance (oppgave nummer 001085020)* (Norwegian only). Letter to Statoil, 26 June.
- Petroleum Safety Authority (2017) *Report of the investigation into the gas leak at Statoil Mongstad on 25 October 2016 — notice of orders.* Letter to Statoil, 7 March.
- Statoil (2017) *Svar på pålegg etter granskingsrapport av brønnkontrollhendelse i brønn 31/2-G-4 BY1H\BY2H på Trollfeltet med boreinnretningen Songa Endurance den 15.10.2016* (Norwegian only). Letter to the Petroleum Safety Authority, undated.
- Petroleum Safety Authority (2017) *Report of the investigation of the well control incident in well 31/2-G-4 BY1H/BY2H on the Troll field with drilling unit Songa Endurance on 15 October 2016 and issue of an order.* Letter to Statoil, 21 February 2017.
- Petroleum Safety Authority (2017) *Order after the investigation of a personal injury (incident of 25/06/2016)*. Letter to Eni Norge AS, 19 January.
- Petroleum Safety Authority (2017) *Order for Eni Norge*. Letter to Eni Norge AS, 11 January.
- Petroleum Safety Authority (2016) *Eni Norge AS has been issued with an order following an incident at Goliat*. Letter to Eni Norge AS, 30 August.
- Industri Energi (2016) *Bekymringsmelding angående ledelsen i Eni* (Norwegian only). Letter to the Petroleum Safety Authority, 13 June.
- Norwegian Petroleum Directorate (2016) *Rettelse til brev om samtykke til oppstart av Goliat FPSO med tilhørende produksjonsfasiliteter* (Norwegian only). Letter to Eni Norge AS, 21 January.
- Norwegian Petroleum Directorate (2016) *Samtykke til oppstart av Goliat FPSO med tilhørende produksjonsfasiliteter* (Norwegian only). Letter to Eni Norge AS, 20 January.
- Norwegian Environment Agency (2016) *Tillatelse etter forurensningsloven for produksjon og drift på Goliatfeltet* (Norwegian only). Letter to Eni Norge AS, 20 January.
- Petroleum Safety Authority (2016) *Samtykke gis til å ta i bruk Goliat FPSO med tilhørende installasjoner* (Norwegian only). Letter to Eni Norge AS, 19 January.

- Norwegian Environment Agency (2016) *Miljødirektoratets uttalelse til søknad om samtykke Goliat* (Norwegian only). Letter to the Petroleum Safety Authority, 19 January.
- Eni Norge AS (2016) *Concerning Consent to put Goliat FPSO into Service*. Letter to the Petroleum Safety Authority, 7 January.
- Statoil (2016) *Vedrørende samtykke til å ta i bruk Goliat FPSO* (Norwegian only). Letter to the Petroleum Safety Authority, 9 January.
- Petroleum Safety Authority (2015) *Songa Endurance — Samtykke til bruk av Songa Endurance* (Norwegian only) Letter to Statoil, 17 December.
- Petroleum Safety Authority (2015) *Songa Endurance — vedtak om samsvarsuttalelse (SUT)* (Norwegian only). Letter to Songa Management A/S, 17 December.
- Petroleum Safety Authority (2015) *Vedrørende samtykke til å ta i bruk Goliat FPSO* (Norwegian only). Letter to Eni Norge AS, 8 December.
- Petroleum Safety Authority (2015) *Statoil sin vurdering i forbindelse med oppstart av Goliat FPSO* (Norwegian only). Letter to Statoil, 8 December.
- Statoil (2015) *Vedlegg til søknad om samtykke til boring og komplettering med Songa Endurance på Troll* (Norwegian only). Letter to the Petroleum Safety Authority, 14 October.
- AS Norske Shell (2015) *Styring av sikkerhet og arbeidsmiljø, vedlikehold og kontroll av stillasutstyr* (Norwegian only). Letter to the Petroleum Safety Authority, 7 August.
- County Governor of Rogaland (2015) *Tilbakemelding til Petroleumstilsynet angående søknad fra Eni Norge til oppstart av produksjonsoperasjoner med innretningen Goliat på Goliatfeltet (PL 229) i Barentshavet* (Norwegian only). Letter to the Petroleum Safety Authority, 18 March.
- Eni Norge AS (2015) *Application for Consent to Put Goliat Facilities into Service*. Letter to the Petroleum Safety Authority, 13 February.
- AS Norske Shell (2015) *A/S Norske Shell — Materialhåndtering og arbeidsmiljø Nyhamna* (Norwegian only). Letter to the Petroleum Safety Authority, 6 February.
- Rogaland Police District (2014) *Underretning til klager* (Norwegian only), report number 12088588, registered 29 May 2012. Letter to the Petroleum Safety Authority, 3 June.
- Petroleum Safety Authority (2014) *Gasslekkasje på Heimdal 26.5.2012, ny uttalelse* (Norwegian only).
- Letter to Rogaland Police District, 31 January.
- Petroleum Safety Authority (2014) *Gasslekkasje på Heimdal 26.5.2012* (Norwegian only). Letter to Rogaland Police District, 15 January.
- Petroleum Safety Authority (2013) *Avslutte gransking etter uønsket hendelse, damplekkasje på Mongstad 8.11.2012* (Norwegian only). Letter to Statoil, 12 September.
- Petroleum Safety Authority (2013) *Tilbakemelding på Statoil sitt svar på pålegg etter gransking av uønsket hendelse på Heimdal – hydrokarbonlekkasje 26.5.2012* (Norwegian only). Letter to Statoil, 21 May.
- Statoil (2013) *Svarbrev til Petroleumstilsynet på granskingsrapport etter damplekkasje 8.11.2012 på Mongstad* (Norwegian only). Letter to the Petroleum Safety Authority, 23 April.
- Petroleum Safety Authority (2013) *Pålegg etter rapport etter gransking av hydrokarbonlekkasje på Heimdal 26.05.2012* (Norwegian only). Letter to Statoil, 24 January.
- Statoil (2013) *Møtereferat — Resultater av aktiviteter som UPN har gjennomført for å måle effekt av tiltak etter alvorlige hendelser* (Norwegian only), Minutes sent to the Petroleum Safety Authority, 10 January.

- Petroleum Safety Authority (2011) *Alvorlig hendelse med gasslekkasje i brønnområdet på Gullfaks B den 4.12.2010 — ber om redegjørelse fra selskapet* (Norwegian only). Letter to Statoil, 21 March.
- Petroleum Safety Authority (2010) *Pålegg etter gjennomført tilsynsaktivitet med Statoils planlegging av brønn 34/10-C-06A på Gullfaks C* (Norwegian only). Letter to Statoil, 6 December.
- Petroleum Safety Authority (2005) *Varsel om pålegg etter gransking av gassutblåsning på Snorre A, brønn 34/7-P-31A 28.11.2004* (Norwegian only). Letter to Statoil, 10 March.

Verified meeting minutes

- Verified minutes from meeting with Ministry of Labour and Social Affairs, 20 June 2018.
- Verified minutes from meeting with Petroleum Safety Authority, 18 June 2018.
- Verified minutes from meeting with TEKNA, 25 May 2018.
- Verified minutes from meeting with NITO, 24 May 2018.
- Verified minutes from meeting with Petroleum Safety Authority, 27 April 2018.
- Verified minutes from meeting with Statoil, 25 April 2018.
- Verified minutes from meeting with AS Norske Shell, 21 March 2018.
- Verified minutes from meeting with the Norwegian Environment Agency, 19 March 2018.
- Verified minutes from meeting with Songa Offshore, 13 March 2018.
- Verified minutes from meeting with Eni Norge AS, 13 March 2018.
- Verified minutes from meeting with Southwestern Police District, 12 March 2018.
- Verified minutes from meeting with Statoil, 12 March 2018.
- Verified minutes from meeting with the County Governor of Rogaland, 8 February 2018.
- Verified minutes from meeting with the Board, 8 February 2018.
- Verified minutes from meeting with Norwegian Oil and Gas, 7 February 2018.
- Verified minutes from meeting with Industri Energi, 15 January 2018.
- Verified minutes from meeting with NITO, 14 December 2017.
- Verified minutes from meeting with the Norwegian Shipowners' Association, 12 December 2017.
- Verified minutes from meeting with Petroleum Safety Authority, weeks 47 and 48 of 2017.
- Verified minutes from meeting with Petroleum Safety Authority, 3 November 2017.

Meeting minutes

- Minutes from meeting between Eni Norge AS and the Petroleum Safety Authority, 4 December 2015.
- Minutes from meeting between Eni Norge AS and the Petroleum Safety Authority, 30 October 2015.
- Minutes from meeting between Eni Norge AS and the Petroleum Safety Authority, 13 October 2015.
- Minutes from meeting between Eni Norge AS and the Petroleum Safety Authority, 20 August 2015.
- Minutes from meeting between Eni Norge AS and the Petroleum Safety Authority, 8 June 2015.
- Minutes from meeting between Eni Norge AS and the Petroleum Safety Authority, 23 February 2015.

Procedures and guidelines

- Petroleum Safety Authority (2017) *Guidelines regarding the Management Regulations*, last updated 18 December 2017.
- Petroleum Safety Authority (2017) *Behandling av varsler om kritikkverdige forhold i petroleumsnæringen* (Norwegian only). Internal guidelines, last updated 7 September 2017.

- Petroleum Safety Authority (2017) *Veiledning til prosedyre for revisjoner i Petroleumstilsynet* (Norwegian only), last updated 1 July 2017.
- Petroleum Safety Authority (2017) *Risikobasert tilsyn i hovedgruppene* (Norwegian only). Internal guidelines, last revised 2 May 2017.
- Petroleum Safety Authority (2017) *Behandling av SUT-søknader* (Norwegian only), dated 1 May 2017.
- Petroleum Safety Authority (2017) *Behandling av SUT-søknader* (Norwegian only). Guidelines concerning procedures for processing of applications for acknowledgement of compliance, dated 1 May 2017.
- Petroleum Safety Authority (2017) *Virkemiddelhåndbok — bruk av virkemidler i tilsynet med helse, miljø og sikkerhet, internal guidelines* (Norwegian only), last updated 1 May 2017.
- Petroleum Safety Authority (2017) *Habilitet i Petroleumstilsynet*. Internal guidelines with appendix, last updated 27 April 2017
- Petroleum Safety Authority (2017) *Revisjonsprosedyre* (Norwegian only), last updated 13 March 2017.
- Petroleum Safety Authority (2016) *Prosedyre for oppfølging av hendelser* (Norwegian only). Internal guidelines, last updated 1 December 2016.
- Petroleum Safety Authority (2017) *Dealing with consent applications, internal work process*, last updated 1 May 2017.

Professional reports, studies and evaluations

- IRIS (2018) *Digitalisering i petroleumsnæringen — Utviklingstrender, kunnskap og forslag til tiltak* (Norwegian only). Report no. 2018/1.
- Oceaneering (2018) *Insulation solutions and safety challenges from a historical perspective* (in Norwegian with English summary). Report no. 2017/957.
- Petroleum Safety Authority (2018) *Sammendragsrapport — Risikonivå i norsk petroleumsvirksomhet 2017* (Norwegian only).
- Ministry of Labour and Social Affairs (2017) *Health, safety and working environment conditions and trends in the Norwegian petroleum industry.*
- Norwegian Petroleum Directorate (2017) *2017 Resource Report for Fields and Discoveries*, 15 June.
- Petroleum Safety Authority (2017) *Sammendragsrapport — Risikonivå i norsk petroleumsvirksomhet 2016* (Norwegian only).
- Norwegian Petroleum Directorate (2016) *Petroleum resources on the Norwegian continental shelf 2016*, 14 April.
- Ministry of Labour and Social Affairs (2013) *Tilsynsstrategi og HMS-regelverk i norsk petroleumsvirksomhet* (Norwegian only).
- Ministry of Petroleum and Energy (2012) *Økt bore- og brønnaktivitet på norsk sokkel* (Norwegian only).
- Sintef (2011) *Deepwater Horizon-ulykken: årsaker, lærepunkter og forbedringstiltak for norsk sokkel* (Norwegian only).
- IRIS (2012) *Læring av hendelser i Statoil: en studie av bakenforliggende årsaker til hendelsen på Gullfaks C og av Statoils læringsevne* (Norwegian only), 16 January.

Other documents

- Statoil (2018) *LPG lekkasje i A-1400 på Mongstad 30.07.2017* (Norwegian only). Investigative report, no date.
- Petroleum Safety Authority (2017) *Looking for Lessons*, in “Safety — status and signals 2016–2017.”
- Statoil (2017) *Sikkerhetsrapport for allmennheten — Hovedrapport ST-11385-6* (Norwegian only), 17 February.
- Statoil (2017) *Well control incident Troll 31/2-G-4 B (Songa Endurance)*. Investigative report, 4 January.

- Statoil (2017) *Lekkasje av H2 rikt prosessmedium i område A-1200 på Mongstad* (Norwegian only). Investigative report, 13 January.
- Statoil (2016) *Report — Statoil Goliat FPSO Review*, 12 February.
- Statoil (2014) *Dybdestudie av RUH 1405809 — Restart av SEPTIC Server MO-WP03* (Norwegian only), 4 July.
- Norwegian Oil and Gas (2011) *Handbook for application for acknowledgement of compliance (AoC).*
- Norwegian Oil and Gas (2006) *104 Recommended guidelines for information security baseline requirements for process control, safety and support ICT systems.*
- Statoil (2005) *Ukontrollert brønnsituasjon i brønn 34/7-P-31 på Snorre A den 28. november 2004* (Norwegian only), 14 January.

Internet sources

- *Shareholder register*. <https://www.altinn.no/en/start-and-run-business/direct-and-indirect-taxes/the-enterprises-tax/shareholder-register/> https://www.altinn.no/en/start-and-run-business/direct-and-indirect-taxes/the-enterprises-tax/shareholder-register/ [28 August 2018]
- *Deepwater Horizon explosion*. <https://en.wikipedia.org/wiki/Deepwater_Horizon_explosion> [28 August 2018]
- *Audit of IT security within Statoil*. <http://www.ptil.no/audit-reports/audit-of-it-security-within-statoil-article12578-889.html> http://www.ptil.no/audit-reports/audit-of-it-security-within-statoil-article12578-889.html> [16 August 2018]
- *Eni can resume Goliat production*. <http://www.ptil.no/enforcement-notices/eni-can-resume-goliat-production-article13227-892.html> http://www.ptil.no/enforcement-notices/eni-can-resume-goliat-production-article13227-892.html> [16 August 2018]
- *Mobile facilities with AoC, overview of mobile facilities with AoC.* <http://www.ptil.no/facilities-with-aoc/category953.html> <http://www.ptil.no/facilities-with-aoc/category953.html> [15 August 2018]
- *Investigations of serious incidents completed.* <https://www.equinor.com/en/news/press-meeting-friday-20-january.html> <https://www.equinor.com/en/news/press-meeting-friday-20-january.html> [27 August 2018]
- *Gullfaks: New approach to enduring problem.* <http://www.ptil.no/well-integrity/gullfaks-new-approach-to-enduring-problem-article8303-900.html> <http://www.ptil.no/well-integrity/gullfaks-new-approach-to-enduring-problem-article8303-900.html> [16 August 2018]
- *Gullfaks C order fulfilled*. <http://www.psa.no/news/gullfaks-c-order-fulfilled-article8675-878.html> <http://www.psa.no/news/gullfaks-c-order-fulfilled-article8675-878.html> [16 August 2018]
- *Heimdal: Failure to benefit from safety efforts.* <http://www.ptil.no/articles-in-safety-status-and-signals-2012-2013/heimdal-failure-to-benefit-from-safety-efforts-article9130-1095.html>
- <http://www.ptil.no/articles-in-safety-status-and-signals-2012-2013/heimdal-failure-to-benefit-from-safety-efforts-article9130-1095.html> [16 August 2018]
- *Minister Hauglie announces new white paper on petroleum safety.* <https://www.regjeringen.no/en/aktuelt/minister-hauglie-announces-new-white-paper-on-petroleum-safety/id2521940/> <https://www.regjeringen.no/en/aktuelt/minister-hauglie-announces-new-white-paper-on-petroleum-safety/id2521940/> [28 August 2018]
- *What is supervision?* <http://www.ptil.no/about-supervision/category888.html> [16 August 2018]
- *Lønnsomhetsberegninger for Goliat* (Norwegian only). <https://www.regjeringen.no/no/aktuelt/l>onnsomhetsberegninger-for-goliat/id2578892/ <https://www.regjeringen.no/no/aktuelt/lonnsomhetsberegninger-for-goliat/id2578892/> [16 August 2018]

- *Oversikt over sektoroppgaver 2018* (Norwegian only). <http://www.ptil.no/getfile.php/1348195/Tilsyn%20p%C3%A5%20nettet/Sektoroppgaver%202018%20rev%2001%20publiseres.pdf> <http://www.ptil.no/getfile.php/1348195/Tilsyn%20p%C3%A5%20nettet/Sektoroppgaver%202018%20rev%2001%20publiseres.pdf> [26 March 2018]
- *Role and area of responsibility*. <http://www.ptil.no/map-of-our-area-of-responsibility/category994.html> http://www.ptil.no/map-of-our-area-of-responsibility/category994.html> [15 August 2018]
- *Consent for start-up of Goliat*. <http://www.npd.no/en/news/News/2015/Consent-for-start-up-of-Goliat/> <http://www.npd.no/en/news/News/2015/Consent-for-start-up-of-Goliat/> [16 August 2018]
- *The PSA has issued an order to Statoil following audits at Oseberg B and Gullfaks C*. http://www.ptil.no/enforcement-notices/order-for-statoil-following-drilling-and-well-investigation-article11443-892.html http://www.ptil.no/enforcement-notices/order-for-statoil-following-drilling-and-well-investigation-article11443-892.html [29 August 2018].

News articles

- E24, online edition 16 November 2017: *Goliat ble utsatt etter notat som spådde marginal lønnsomhet* (Norwegian only).
- NRK, online edition 28 October 2016: *Tastefeilen som stoppet Statoil* (Norwegian only).
- Reuters, online edition January 2018: *BP Deepwater Horizon costs balloon to $65 billion*.
- Stavanger Aftenblad, online edition 29 April 2017: *Ptil-direktøren advarer mot følger av kostnadskutt* (Norwegian only).
- Sysla, online edition 11 January 2017: *Derfor fikk du aldri vite resultatet av storaksjonen* (Norwegian only).
- Teknisk Ukeblad, online edition 7 May 2015: Nå er Goliat på vei ut i Barentshavet (Norwegian only).
- Teknisk Ukeblad, online edition 22 April 2015: *Eni-sjefen om Goliat: 100 000 fat om dagen før årsskiftet* (Norwegian only).
- Teknisk Ukeblad, online edition 16 February 2015: *Dette er unikt med Goliat* (Norwegian only).
- Teknisk Ukeblad, online edition 13 February 2015: *I dag seiler Goliat fra Korea* (Norwegian only).

13 Appendices

Appendix 1 The PSA's supervisory practices — categories of nonconformities in the supervision of different topics

In the figures below, every single nonconformity is categorised. The figures show how the various categorised nonconformities are distributed across audits with different topics. One audit can have multiple topics. Audits with multiple topics, for example working environment and emergency preparedness, are included in multiple places. For example, Figure 19 shows that in audits with the topic of working environment, nonconformities are identified not only in the topic of working environment but also in the topics of logistics, management, etc. Figure 19 shows categories of nonconformities in supervision of the topics of working environment, preparedness, maintenance, logistics and barriers.

Figure 19 Categories of nonconformities in supervision of the topics of working environment, preparedness, maintenance, logistics and barriers

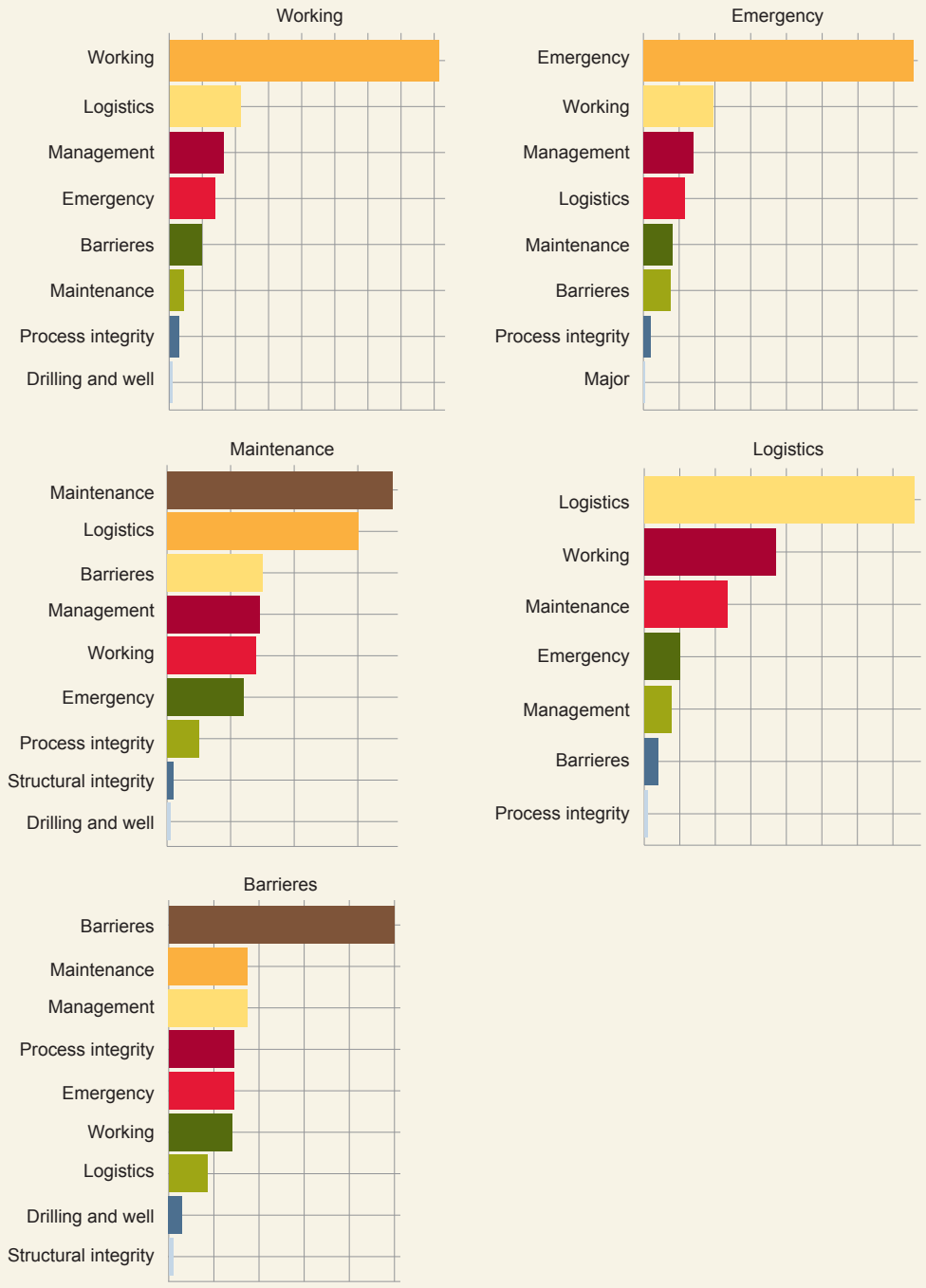
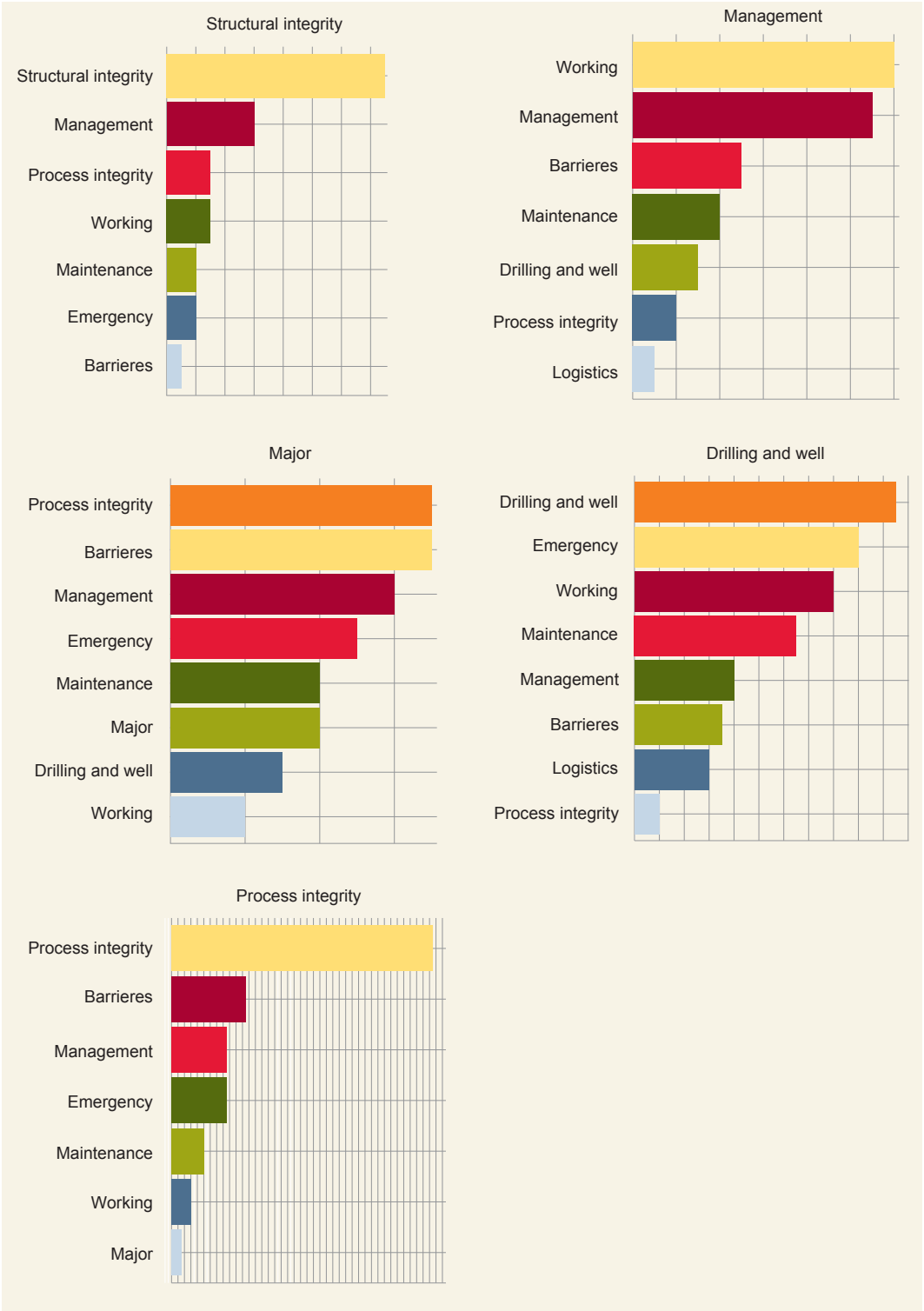


Figure 20 shows categories of nonconformities in supervision of the topics of structural integrity, process integrity, drilling and well technology, management and major accidents.

Figure 20 Categories of nonconformities in supervision of the topics of structural integrity, process integrity, drilling and well technology, management and major accidents



Appendix 2 Refinement of coinciding causes of the serious incidents on Snorre A, Gullfaks C and B, Heimdal and Songa Endurance (Troll) where Equinor was the operator

Insufficient planning and compliance with procedures

According to the PSA's investigative report, there was insufficient compliance with procedures in connection with the planning, management of change and execution of the operation that resulted in the incident on Songa Endurance. There were similar findings in investigations/supervision following all of the other incidents — Snorre A in 2004, Gullfaks C and B in 2010 and Heimdal in 2012.

Insufficient management of change (MOC)

According to the PSA's investigative report, insufficient management of change was an underlying cause of the incident on Songa Endurance. According to information that came to light during the investigation, there was a strong focus on reducing costs and finding new ways to streamline the operations. Prior to the Songa Endurance incident, changes to the plans were introduced without carrying out sufficient processes to identify changes in the potential risks. Similar findings also appeared in the investigations/supervision following the incidents on Snorre A and Gullfaks C.

Snorre A

During the planning of the operation on Snorre A, changes were made to the original plan prior to the incident. The original plan for slot recovery (September 2004) had taken into account deficiencies in the well's integrity and determined that the reservoir section should not be opened and cemented. However, in October the original plan was changed. It was suggested that the reservoir section of well P-31 A be cemented using "squeeze cementing" to avoid communication with the later sidetrack P-31 B. The suggestion for cementing was accepted in late October and the original operation programme was changed to reflect the decision.[302] The fact that the original programme was changed without sufficient MOC and understanding of quality assurance is also presented in Equinor's investigation as a factor that the Snorre A incident had in common with the incident on Songa Endurance[303]

Gullfaks C

A risk review for the entire programme was planned for 12 November, but was postponed due to a scheduling conflict and it having a lower priority among the participants. On 19 November the risk review was cancelled, and the same day the slot recovery operation began on SNA after the installation of a BOP and risers for drilling.[304]

According to the PSA's investigative report, there was insufficient risk management and MOC prior to the incident on Gullfaks C. The risk management requirements were not sufficiently upheld, and it was proven that changes in plans were not managed in accordance with Equinor's own procedures for change control. The report Læring av hendelser i Statoil (Learning from incidents at Statoil; Norwegian only), which was ordered by Equinor and prepared by the International Research Institute of Stavanger (IRIS) in 2011, states that several members of the Gullfaks organisation feel that Gullfaks has been characterised by a culture in which individuals can do things their own way, independent of governing documents.[305]

302) Petroleum Safety Authority (2005) *Gransking av gassutblåsing på Snorre A, brønn 34/7-P31 A 28.11.2004* (Norwegian only), no date.
303) Statoil (2017) *Well control incident Troll 31/2-G-4 B (Songa Endurance)*. Investigative report, 4 January.
304) Petroleum Safety Authority (2005) *Gransking av gassutblåsing på Snorre A, brønn 34/7-P31 A 28.11.2004* (Norwegian only), no date.
305) IRIS (2012) *Læring av hendelser i Statoil: en studie av bakenforliggende årsaker til hendelsen på Gullfaks C og av Statoils læringsevne* (Norwegian only), 16 January.

The fact that the drilling programme was changed without documentation or formal approval is also presented in Equinor's investigation as a common factor leading to the incidents on Gullfaks C and Songa Endurance.[306]

Lacking technical, organisational and operational barriers
Findings were also made concerning the lack of technical, organisational and operational barriers following the incidents on Snorre A and Gullfaks B. The investigation following the incident on Heimdal in 2012 describes a similar problem as "inadequate design solutions".

Snorre A
The PSA's investigation following the incident on Snorre A lists breaches of well barriers as one of the causes of the incident. The report states that during the planning stage there was no assessment of the consequences of the various sub-operations and of the impact changes along the way would have on the overall well barrier situation. Pressure tests of well barriers were not planned, and a well that had been closed due to insufficient integrity was reopened, even though the complexity and insufficient integrity were known beforehand.[307]

Gullfaks C
A common factor in the incidents on Gullfaks C and Songa Endurance is, according to Equinor's investigation, the use of a shared barrier element that resulted in dependency between the primary and secondary barriers.[308]

Gullfaks B
The investigation following the incident on Gullfaks B revealed that no specific strategies or principles had been established for the design of barriers on the platform. There were also no facility-specific performance requirements established for all barrier elements that are necessary for the effectiveness of the individual barrier. The report states that the lack of a specific safety strategy and the lack of specific performance standards contributed to the fact that the platform personnel at the facility were not sufficiently familiar with the functions of all the barriers or barrier elements.[309]

Heimdal
The PSA's investigation following the incident on Heimdal identified inadequate design solutions as one of the causes of the incident. The pipe system was not designed in a way that sufficiently limited the possibility of human error. For example, it was possible to expose a portion of the pipeline to the overpressure flare. The chosen design solution was also in breach of the basic protection principles of the current standards, but it was a common design solution when the platform was new. There were no established procedures to ensure that the block valve was in the proper position to avoid overpressure in the pipeline and in the vale itself. [310]

Insufficient risk analyses and understanding of risks
After all the incidents there were findings that suggested insufficient risk analyses and/or insufficient understanding of risks.

306) Statoil (2017) *Well control incident Troll 31/2-G-4 B (Songa Endurance)*. Investigative report, 4 January.
307) Petroleum Safety Authority (2005) *Gransking av gassutblåsing på Snorre A, brønn 34/7-P31 A 28.11.2004* (Norwegian only), no date.
308) Statoil (2017) *Well control incident Troll 31/2-G-4 B (Songa Endurance)*. Investigative report, 4 January.
309) Petroleum Safety Authority (2011) *Gas leak on Gullfaks B 4 December 2010*, 11 March.
310) Petroleum Safety Authority (2012) *Report from the investigation of a hydrocarbon leak on Heimdal*, 26 May 2012, 20 December.

Snorre A
An underlying cause of the incident on Snorre A in 2004 was the lack of understanding and execution of risk analyses. In the PSA's investigative report it emerged at this was largely the case during the planning stage, but also during the execution. The investigation also found a low priority given to reviews of risks, inadequate understanding of comprehensive risks and, incidentally, that risk contribution was removed from the detailed programme. According to Equinor's own investigation, an underlying cause was that "the organisation demonstrated a lack of understanding regarding the need for risk analyses".[311]

The IRIS report that was developed on the request of Equinor in 2011 further points out that the Snorre A organisation had developed a high degree of "risk tolerance", meaning that goals were set for production, operational regularity and progress at the expense of safety margins. According to the report, this was a ripple effect of the operator's emphasis on efficiency and profitability.[312]

Gullfaks C
The PSA's audit report following the incident on Gullfaks C states that risk factors were not identified or sufficiently dealt with during the two-year planning of the well. The methods used in the many risk assessments and analyses did not reflect the complexity of the operation and were not executed and documented in accordance with Equinor's own requirements.[313]

Gullfaks B
Insufficient risk analysis is also one of the findings of the investigation following the incident on Gullfaks B. The report states that risks relating to pressure build-up between the subsurface safety valve and the hydraulic master valve were not identified or assessed during the planning and execution of the work. The report further revealed that Equinor soon after planned a similar operation with throttle valves in spite of the incident. A nonconformity was also discovered concerning the updating of risk analyses. The PSA found that Equinor had not done enough to update risk analyses that would have provided a nuanced and comprehensive picture of the explosion risk and clarified the challenges involved with use. There was also no documentation indicating that the risk of explosion had been reduced as much as possible.

Heimdal
Following the incident on Heimdal, it was discovered that there had not been sufficient risk analysis in the planning of the operation. The planning of the activities did not ensure that key risk factors were identified, and the activity was not managed and executed in a way that prevented the incident. The PSA also found that Equinor had not ensured that personnel in Heimdal's onshore and offshore organisation had the necessary competence and understanding of risks to be able to perform the work safely.[314]

According to the PSA's investigation, interviews offshore and in Heimdal's onshore organisation gave the general impression that the responsible personnel paid little attention to the risk of hydrocarbon leaks on Heimdal. The report also pointed out that the risk of hydrocarbon leaks on Heimdal and the importance of preventing such leaks

311) Statoil (2005) *Ukontrollert brønnsituasjon i brønn 34/7-P-31 på Snorre A den 28. november 2004* (Norwegian only), 14 January.
312) IRIS (2012) *Læring av hendelser i Statoil: en studie av bakenforliggende årsaker til hendelsen på Gullfaks C og av Statoils læringsevne* (Norwegian only), 16 January.
313) Petroleum Safety Authority (2010) *Audit of Statoil's planning for well 34/10-C-06A*, no date.
314) Petroleum Safety Authority (2012) *Report from the investigation of a hydrocarbon leak on Heimdal, 26 May 2012*, 20 December.

were not discussed in key strategic documents and systems that form the basis for safe operation of the platform.[315]

Lack of involvement of personnel with relevant familiarity with the equipment
Relevant personnel were not involved in the planning meetings prior to the drilling operation with Songa Endurance. Similar findings were made in the investigations following the incidents on Gullfaks C and Snorre A.

Snorre A
According to the PSA's investigative report on the Snorre A incident, the drilling contractor was not involved in the detail planning meetings held in the period September–November 2004.[316] Nor were competence units brought in to identify deficiencies in the risk analysis and in the training of personnel in the use of procedures.[317]

Insufficient use of knowledge and competence across the units of the Snorre A organisation is identified in Equinor's investigation as a cause that the Snorre A incident has in common with the Songa Endurance incident.[318]

Gullfaks C
The PSA's supervisory report following the incident on Gullfaks C states that necessary resources and competence were not involved in the planning phase.[319]

Insufficient competence
Lack of competence was identified as a finding in the investigations following the incidents on Gullfaks C, Gullfaks B and Heimdal.

Gullfaks C
IRIS's report *Læring av hendelser i Statoil* states that large portions of the management on Gullfaks C had been transferred out, and, according to the report, the failure to transfer experience in this process and the subsequent lack of field-specific competence was an underlying cause of the incident on Gullfaks C.[320] One of the nonconformities identified in the PSA's investigation following the incident on Gullfaks C in 2010 was insufficient transfer of experience and use of relevant competence. The PSA pointed out that experience from previous wells on the Gullfaks field had not been assessed thoroughly enough, and that the people who planned the work on the well had little operational experience with pressure-balanced operations and with the Gullfaks field in general. The responsible persons chose not to draw on competence outside of their own organisation, and the MPD environment was not much involved in the planning of the well until it was decided in the final stage to use pressure-balanced drilling. The MPD environment was also not involved in the assessment of the drillability or the classification of wells that must be drilled using MPD, even though they are the ones with expertise on the subject.[321]

315) Petroleum Safety Authority (2012) *Report from the investigation of a hydrocarbon leak on Heimdal, 26 May 2012*, 20 December.
316) Petroleum Safety Authority (2005) *Gransking av gassutblåsing på Snorre A, brønn 34/7-P31 A 28.11.2004* (Norwegian only), no date.
317) Petroleum Safety Authority (2005) *Gransking av gassutblåsing på Snorre A, brønn 34/7-P31 A 28.11.2004* (Norwegian only), no date.
318) Statoil (2017) *Well control incident Troll 31/2-G-4 B (Songa Endurance)*. Investigative report, 4 January.
319) Petroleum Safety Authority (2010) *Audit of Statoil's planning for well 34/10-C-06A*, no date.
320) IRIS (2012) *Læring av hendelser i Statoil: en studie av bakenforliggende årsaker til hendelsen på Gullfaks C og av Statoils læringsevne* (Norwegian only), 16 January.
321) IRIS (2012) *Læring av hendelser i Statoil: en studie av bakenforliggende årsaker til hendelsen på Gullfaks C og av Statoils læringsevne* (Norwegian only), 16 January.

Gullfaks B

The PSA found that there was a failure to ensure sufficient capacity and competence prior to the incident on Gullfaks B. The process technicians who performed the work did not have familiarity with the platform or experience with leading this type of work. The technical expert also did not have the opportunity to follow up the work properly, neither in the planning phase nor in the execution. Neither of the two process technicians had participated in a training course on land relating to work with pressurised systems.

Heimdal

Following the incident on Heimdal, the PSA's investigation found that Statoil had not ensured that personnel in both the onshore and offshore organisation had the necessary competence and understanding of risks to be able to perform the work safely.[322] Management at all levels within Statoil with responsibility for Heimdal had failed to ensure that relevant risk factors were illuminated and used in the training of personnel.

322) Petroleum Safety Authority (2012) *Report from the investigation of a hydrocarbon leak on Heimdal, 26 May 2012*, 20 December.

Appendix 3 The PSA's follow-up of serious incidents on Snorre A, Gullfaks B and C, Heimdal and Songa Endurance (Troll)

In the period 2004–2016 there were several serious incidents on the Norwegian continental shelf where Equinor was the operator. The incidents were judged to have a serious potential for harm or a major accident potential with subsequent danger to human life. The PSA has pointed out similar characteristics between the incidents in its investigative and audit reports. The incidents consisted of three well control incidents in connection with production drilling and two hydrocarbon leaks in connection with the testing of valves for use in production drilling. The investigative and audit reports following the incidents indicate that there were breaches of barriers (technical, human or operational) with subsequent gas leaks.

The direct causes of the incidents are highly dissimilar and difficult to compare, and the same can be said of the technical operations that they occurred in connection with. The incidents occurred in different phases of different operations and at different times. The underlying reasons why one or several barrier elements failed and led to the incident, however, have several features in common.

Table 16 Investigations of serious incidents where Equinor was an operator in the period 2004–2016

Facility/ installation	Type of operation and incident	Nonconformity found in the PSA's investigation/supervision
Snorre A (2004)	Well operation/slot recovery with subsequent gas blowout	- Failure to comply with governing documents - Lack of understanding and execution of risk analyses - Insufficient involvement of management - Breach of well barriers
Gullfaks C (2010)*	Drilling and completion operation	- Relevant risk factors not sufficiently identified and addressed during planning of the well - Necessary resources and competence not involved in the planning phase - The methods used for conducting the many risk analyses did not reflect the complexity of the operation - Experience from previous wells, such as well incidents, pressure measurements and general familiarity with the area, was not adequately utilised in the planning work - Challenges related to operations in the well were not sufficiently evaluated and addressed, and the chosen solutions were not verified and qualified - Management did not conduct sufficient follow-up to ensure that the planning of the operation was carried out in accordance with the company's requirements, HSE policy and strategy
Gullfaks B (2010)	Testing of well control equipment. Hydrocarbon leak in connection with leak testing following maintenance work on a production well	- Insufficient planning of the work - Insufficient testing of barrier valves identified in the insulation plan - Insufficient planning of leak test clearance - Insufficient risk analysis - Leak in manual master valve - Deficiencies in the emergency shut-off system - Failure to ensure adequate capacity and competence
Heimdal (2012)	Hydrocarbon leak in connection with testing of two emergency shut-off valves	- Inadequate design solution - Inadequate design solution was not identified - Insufficient descriptions of how the work was to be performed - Deficiencies in Equinor's document management - Deficiencies in risk analysis in planning phase - Deficiencies connected with competence and understanding of risks
Songa Endurance (2016)	Well intervention and plugging with subsequent gas blowout	- Insufficient planning and compliance with procedures - Insufficient management of change (MOC) - Lacking technical, organisational and operational barriers - Insufficient risk analyses, lack of thorough risk analyses in connection with the choice of new method, in addition to insufficient understanding of risks - Lack of involvement of personnel with relevant familiarity with the equipment - Insufficient competence

* There was no investigation following the incident on Gullfaks C, but there was an audit that dealt with the preparatory work prior to the operation.

Table 16 shows the main findings of various investigations and supervisory activities carried out following serious incidents in the period 2004–2016 for which Equinor was the operator. Many of the nonconformities found after the various incidents reoccur as underlying causes in several of the investigations. This is especially true for insufficient risk analyses, insufficient planning and failure to comply with internal requirements and procedures within the company.

Table 17 shows how the causes that reoccur are distributed across the different incidents.

Table 17 Underlying causes that reoccur in the incidents

	Insufficient risk analyses	Insufficient compliance with procedure	Lack of management of change	Lack of barriers	Insufficient involvement of relevant personnel	Insufficient competence
Snorre A 2004	X	X	X	X	X	
Gullfaks C 2010	X	X	X		X	X
Gullfaks B 2010	X	X		X		X
Heimdal 2012	X	X	X	X		X
Songa Endurance 2016	X	X	X	X	X	X

Snorre A

An uncontrolled gas blowout occurred during work on a well on the Snorre A platform on 28 November 2004. Pure coincidence and favourable circumstances prevented the occurrence of a major accident with the potential for loss of human life, damage to the environment and further loss of material assets. The incident led to major financial losses in connection with delayed production on the Snorre oil field.[323] The PSA described the incident as one of the most serious to occur on the Norwegian continental shelf. In its investigative report following the incident, the PSA pointed out serious failures and deficiencies in all stages of Equinor's planning and completion of the well.

According to the PSA's investigative report following the incident, the drilling contractor was not involved in detail-planning meetings held in the period September–November 2004.[324] The investigative report also mentions among the nonconformities the lack of compliance with governing documents in connection with the planning of drilling and completion operations. og brønnoperasjoner og manglende etterlevelse av prosedyre for brønnkontroll i forbindelse med bore- og kompletteringsoperasjoner. The report also states that failure to comply with procedures was repeated in all phases of the operation, but particularly during planning.[325]

323) Petroleum Safety Authority (2005) *Gransking av gassutblåsing på Snorre A, brønn 34/7-P31 A 28.11.2004* (Norwegian only), no date.
324) Petroleum Safety Authority (2005) *Gransking av gassutblåsing på Snorre A, brønn 34/7-P31 A 28.11.2004* (Norwegian only), no date.
325) Petroleum Safety Authority (2005) *Gransking av gassutblåsing på Snorre A, brønn 34/7-P31 A 28.11.2004* (Norwegian only), no date.

According to Equinor's own investigation following the incident, shifting requirements for management and execution, and possibly differing business philosophies and company cultures in connection with the change of operator the year prior to the incident, contributed to uncertainty and misinterpretations in the work processes that were carried out.[326]

Equinor was ordered to:[327]

- prepare a binding and time-delimited plan for activities that can identify the reasons for the nonconformities identified in the report
- carry out the activities in accordance with the stated plan
- present the results of the work with the execution of the activities in accordance with the stated plan. This included ensuring compliance with governing documents, that line management for drilling and well activities are involved and complete assigned tasks in accordance with governing documents, that risk analyses are carried out and implemented in the planning and execution of drilling and well activities on the platform and at least two independent and tested well barriers are arranged for, and that status and function are known in the planning and execution of drilling and well activities on the platform
- implement the measures and measure their effects in relation to the stated plan
- present results from the implementation of measures and from the measurement of their effects

Gullfaks C

On 19 May 2010 Equinor lost control of a well on the Gullfaks C platform. In the period from November 2009 to July 2010, the same well was the site of several serious well control incidents that led to plugging and temporary abandonment. The incident did not result in any personal injuries or emissions, but under slightly different circumstances it could have turned into a major accident in the form of an underground blowout and/or an explosion.

The PSA's audit report following the incident concludes that there were serious deficiencies in Equinor's planning of the well. The report notes that the company's planning did not reflect the challenges that could be expected and that arose along the way. The planning was also not carried out in accordance with the company's internal requirements, key requirements of governing documents were not utilised and the different decision-making processes were inadequately documented.[328] According to the PSA, Equinor's management, at all levels, should have done more to ensure that the operation was being planned in accordance with the company's requirements, HSE policy and strategy. The PSA concludes in its report that pressure-balanced operations were not a standard operation at the time that the incident occurred, and that the planning should have taken this into account.[329]

The audit report also states that Equinor had identified several challenges in connection with following up incidents and learning from them. The challenges were related to quality in planning, quality and precision in the execution of work, the understanding of risks, compliance and leadership. These challenges applied to the entire Norwegian continental shelf (the business area Development and production Norway at Statoil) and correlated with the findings of the PSA's follow-up of serious incidents on Snorre A in 2004 and Statfjord A in 2008, and with cuttings injections on

326) Statoil (2005) *Ukontrollert brønnsituasjon i brønn 34/7-P-31 på Snorre A den 28. november 2004* (Norwegian only), 14 January.
327) Petroleum Safety Authority (2005) *Varsel om pålegg etter gransking av gassutblåsning på Snorre A, brønn 34/7-P-31A 28.11.2004* (Norwegian only). Letter to Statoil, 10 March.
328) Petroleum Safety Authority (2010) *Audit of Statoil's planning for well 34/10-C-06A*, no date.
329) Petroleum Safety Authority (2010) *Audit of Statoil's planning for well 34/10-C-06A*, no date.

Statoil-operated fields in the period 2007–2010. The involvement of necessary professionals in planning and risk analysis is still identified as a challenge despite the fact that an order was issued to strengthen these efforts following the Snorre A incident in 2004.

Equinor was ordered to:[330]

- greview and evaluate compliance with work processes that were established to ensure quality and robustness in the well construction process on Gullfaks. The work was to include an investigation of why crucial deficiencies were not caught along the way. Necessary improvement measures relating to work processes and the use thereof were to be identified and implemented;
- carry out an independent assessment of how measures implemented following previous incidents, including the gas blowout on Snorre A in 2004 with similar causes, did not have the desired effect on Gullfaks. Based on the result of this work, the company was to assess whether there was a need to implement new and adapted improvement measures on Gullfaks;
- evaluate the results of the work completed under points 1 and 2, and on the basis of the measures implemented in the rest of the company;
- prepare a binding plan for how this work was to be implemented and followed up. This plan was to be submitted to the PSA.

Gullfaks B

On 4 December 2010 a new gas leak occurred on Equinor's Gullfaks B platform. The incident could have, under slightly different circumstances, resulted in a major accident.[331] Personnel who were present in the area could have suffered serious injuries or been killed if the gas had been ignited.[332] In its investigative report the PSA identified nine nonconformities.

Instead of issuing an order, the PSA chose to send an open letter to the head of development and production on the Norwegian continental shelf at Equinor.[333] The background for this was that the incident occurred only one month after the Deepwater Horizon incident in the Gulf of Mexico, the authority was in the process of issuing an order in connection with the Gullfaks C incident, and the investigation identified serious and pervasive deficiencies in the planning of the drilling operation. The PSA and other parties had also pointed out correlations between the Gullfaks B incident on the one hand and the Gullfaks C incident the same year and the incident on Snorre A in 2004 on the other.[334]

In July 2012 the PSA stated that Equinor had done a lot of important work and had implemented comprehensive measures that were judged to be appropriate. The PSA therefore considered the order following the Gullfaks C incident to be fulfilled.[335] The order that was issued following the Gullfaks C incident was not limited in its scope to that platform, but applied to Gullfaks in general.[336] When the PSA considered the order to be fulfilled, this can be understood to apply to both Gullfaks incidents.

330) Petroleum Safety Authority (2010) *Pålegg etter gjennomført tilsynsaktivitet med Statoils planlegging av brønn 34/10-C-06A på Gullfaks C* (Norwegian only). Letter to Statoil, 6 December.
331) Petroleum Safety Authority (2011) *Gas leak on Gullfaks B 4 December 2010*, 11 March.
332) Petroleum Safety Authority (2011) *Gas leak on Gullfaks B 4 December 2010*, 11 March.
333) Petroleum Safety Authority (2011) *Alvorlig hendelse med gasslekkasje i brønnområdet på Gullfaks B den 4.12.2010 — ber om redegjørelse fra selskapet* (Norwegian only). Letter to Statoil, 21 March.
334) *Gullfaks: New approach to enduring problem.* <http://www.ptil.no/well-integrity/gullfaks-new-approach-to-enduring-problem-article8303-900.html> <http://www.ptil.no/well-integrity/gullfaks-new-approach-to-enduring-problem-article8303-900.html> [16 August 2018].
335) *Gullfaks C order fulfilled.* <http://www.psa.no/news/gullfaks-c-order-fulfilled-article8675-878.html> [16 August 2018]
336) Petroleum Safety Authority (2010) *Pålegg etter gjennomført tilsynsaktivitet med Statoils planlegging av brønn 34/10-C-06A på Gullfaks C* (Norwegian only). Letter to Statoil, 6 December.

Heimdal

On 26 May 2012, two months before the PSA declared its satisfaction with Equinor's follow-up of the Gullfaks incidents, a gas leak occurred on the Heimdal platform during testing of emergency shut-off valves. According to the PSA's Investigative report, the incident had a significant potential for harm if the gas had been ignited, or under slightly different circumstances.[337] The leak was one of the largest and most serious to occur on the Norwegian continental shelf in several years, and had significant potential for a major accident. The PSA's investigation showed that key improvement measures that Equinor had identified and implemented following previous incidents, such asGullfaks B in 2010, had not had the expected effect on the Heimdal field.[338] The authority's investigative report identified nine nonconformities.

Equinor was ordered to:[339]

- identify the reasons why the improvement measures implemented by Equinor did not have the necessary effect on Heimdal
- ensure that the aforementioned improvement measures had the necessary effect on Heimdal
- present a plan for the work necessary to achieve this
- confirm that there were no conditions that would indicate the insufficient effect of the said measures on other Equinor platforms

337) Petroleum Safety Authority (2012) *Report from the investigation of a hydrocarbon leak on Heimdal, 26 May 2012*, 20 December.

338) *Heimdal: failure to benefit from safety efforts.* <http://www.ptil.no/articles-in-safety-status-and-signals-2012-2013/heimdal-failure-to-benefit-from-safety-efforts-article9130-1095.html> <http://www.ptil.no/articles-in-safety-status-and-signals-2012-2013/heimdal-failure-to-benefit-from-safety-efforts-article9130-1095.html> [16 August 2018].

339) Petroleum Safety Authority (2013) *Pålegg etter rapport etter gransking av hydrokarbonlekkasje på Heimdal 26.05.2012* (Norwegian only). Letter to Statoil, 24 January.

Appendix 4 Supervision carried out on Nyhamna in the period 2011–2017

Table 18 provides an overview of the supervision of Nyhamna in the period 2011–2017. The table shows what year the supervision was conducted, the topic of the supervision, and what nonconformities and improvement points the supervision identified.

Table 18 The PSA's supervision of the Nyhamna onshore production facility in the period 2012–2017

Year	Title	Topic	Nonconformities	Improvement points
2011	Supervision of comprehensive	Working	- Insufficient mapping and risk analysis of chemical exposure and did not provide an adequate decisionmaking basis for improvement measures - Duty to substitute chemicals due to health risk was not followed up to a sufficient extent - Requirements for HSE-related chemical information	
2012	Supervision of operation of pipelines, subsea facilities and onshore facilities — Ormen	Technical/operational safety, natural		- Temporary procedures – deficiencies connected to follow-up of nonconformities and use of procedures - Alarms in control rooms (also identified in 2009) – deficiencies in prioritisation of alarms in
2013	Major accident supervision, barrier management and	Major accidents		- Updating of preparedness analysis - Repeated gas emissions in connection with ship
2013	Supervision of G4S at Nyhamna concerning working environment and	Working environment	- Mapping and risk analysis of working environment factors (the mapping was not adapted for place-specific conditions at Nyhamna). - Measures — insufficient evaluation, prioritisation and verification of measures to reduce working environment risks (noise, chemicals, ergonomics, emergency preparedness and reception) - Competence	- Clarification of roles and for personnel with tasks connected to G4S employees at Nyhamna
2014	Supervision of Nyhamna expansion — detail project engineering and	Project engineering and		- Possible disagreement — explosion loads noted in QRA are higher than loads used in sizing of individual existing buildings - Possibility of uncontrolled corrosion resulting from high temperatures in flare - In certain pressure-release situations, exceedingly low temperatures can occur in flares

Table 18 The PSA's supervision of the Nyhamna onshore production facility in the period 2012–2017

Year	Title	Topic	Nonconformities	Improvement points
2015	Report following supervision management of working environment and material handling during the development at Nyhamna	Working environment and logistics	- Systematic mapping and risk analysis of working environment factors - Regulatory competence among subcontractors and their safety representatives - Employee participation - Insufficient fulfilment of see-to-duty - Insufficient system for maintance of knowledge	- Working environment — of collaboration between safety officers and management in operations - Deficient system for maintaining of safe conditions on steel cables - Material handling plan - Operationally responsible - Lack of respect for learning and for blocking of areas for lifting operations - Lack of lifting competence in contractors involved in "Civil" contract
2015	Supervision of management environment, maintenance and control of scaffolding equipment	Working environment and maintenance	- Insufficient control of safety and scaffolding in the facility working - Insufficient education in use of hoisting gear - Insufficient fulfilment of see-to-it duty - Deficiencies in safety service	
2015 (2016 in database)	Supervision of Nyhamna - barrier management and risk management	Barrier management and risk management	- Insufficient system for the reducing risks as much as possible - Uncertainty in risk analyses	
2016 The supervisory activity included all the onshore facilities and Gassco.	Supervision of onshore facilities, reduction of risk of major accidents, Nyhamna	Major accidents		
2016	Follow-up of findings previous supervision within the working environment and lifting operations	Working environment and lifting operations	- Crane and lifting operations	- Incorrect regulatory from references - Facilitation of employee participation in the project
2016	Supervision of alarm load and Human Factors in the control room at Nyhamna	Alarm load		

Appendix 5 Supervision, investigations and follow-up of previous supervision and investigations at Mongstad in which maintenance is the theme or is discussed

Table 19 shows the audits that the PSA conducted at Mongstad in the period 2011–2018. In the audits in which maintenance is not mentioned, the fields for nonconformities and improvement points are hatched.

Table 19 The PSA's supervision at Mongstad in the period 2011–2018

Year	Title/topic	Nonconformities	Improvement points
2011	Audit of maintenance management at Mongstad	- Insufficient measurement parameters and indicators for monitoring maintenance - Insufficient follow-up of systems and equipment - Insufficient classification of systems and equipment - Maintenance programme is missing or deficient - Handling of nonconformities	
2012	Organisational barriers — preparedness		
2013	Major accident/preparedness/ learning in the organisation — preparedness		
2014	Major accident — major accident	- Incorrect use of suspended scaffolding - Insufficient internal audits of scaffolding - Insufficient see-to-it duty regarding scaffolding - Insufficient maintenance of scaffolding materials - Education of personnel - Experience and learning from incidents	- Information duty to users of scaffolding - Language on labels - Use of "roof-over-roof" is not described in the scaffolding handbook - Deficiencies in governing documentation from Bilfinger
2015	Supervision of electrical facilities — electrical facilities		
2015	Report following audit of a major accident at Mongstad Production facility — major accident		- Large backlog of corrective maintenance
2016	Follow-up of incidents involving lathe and LPG loading arm — incident		
2016	Audit of surface maintenance and corrosion under insulation at Equinor Mongstad — maintenance		- Identification of an increasing number of leaks — there was a marked increase in the number of leaks the previous year, and the reason for this is not known - Maintenance scope — the total need for surface maintenance has not been evaluated in specific plans or budgets
2017	Working environment risk/ participation — working environment		
2017	Report of audit of a major accident Mongstad — major accident	- Risk analysis upon postponement of preventative maintenance on ESD valve - Use of experience data — failure to use facility-specific historical experience data when evaluating test intervals for safety-critical valves	- Categorisation of safety-critical valves — flue gas valve placed in the wrong system category

Table 19 The PSA's supervision at Mongstad in the period 2011–2018

Year	Title/topic	Nonconformities	Improvement points
2018	Audit of Equinor — follow-up after incident 25/10/2016 — maintenance		- Capacity drainage — limited capacity of drainage system in area B3
2018	Audit of Equinor ASA's management of barriers at Mongstad		- Barrier management — handling of danger and accident situations

Table 20 shows what investigations the PSA has conducted of serious incidents at Mongstad, and what regulatory nonconformities and improvement points were identified in the investigations.

Table 20 Noted regulatory nonconformities and improvement points in investigations carried out following serious incidents at Mongstad

Year	Title	Nonconformities	Improvement points
2010	Gas leak at Mongstad, 8/2/2010	- Insufficient risk analysis in the planning phase - Insufficient competence and understanding of risks	- Follow-up of language abilities among workers
2013	Investigative report following steam leak at Mongstad, 8/11/2012	- System for control of corrosion under insulation not fully taken care of - Corrosion follow-up of pipes and systems that are used periodically and experience changes in temperature is not adequately taken care of - Delay in notifying the PSA of the incident	- Risk analysis for repair of steam leaks is insufficient - The surface programme has made little progress - Pipe class and original design requirements for steam separator and steam boiler are different and could cause ambiguity - Labelling of pipes and valves is insufficient - Deficiencies in communication between external operators and control room in noisy conditions - Procedures for and understanding of overriding security functions could be improved
2017	The gas leak at Statoil Mongstad, 25/10/2016	- The facility was not properly maintained - Insufficient risk analysis prior to commencement of activity - Insufficient information about risks - Insufficient control of personnel upon evacuation	- Lack of system for emergency pressure release of A-1200 - Insufficient gas detection - Factory alarm does not have the desired effect in the entire facility - Insufficient radio communication
2018	Mongstad refinery — Naphta leak in cracker, 24/10/2017	- Insufficient analysis when changing operating conditions - Deficiencies in maintenance and inspection - Insufficient compliance with procedures and transmission of information for safe operation of the facility - Insufficient understanding of risks and failure to identify risk factors when cleaning up materials contaminated with naphta	- The evacuation alarm did not work

Follow-up of investigation of gas leak in 2010
In its response to the investigative report, Statoil notes that they carried out their own investigation and introduced several measures to address the regulatory nonconformities and improvement points noted in the authority's investigative report.[340] The PSA concluded its investigation by stating that they had taken note of Statoil's response.[341]

Follow-up of audit of maintenance management in 2011
In its response to the audit report from the audit of maintenance management in 2011, Statoil gave the general impression that they are prioritising maintenance and that they have control over it.[342] Statoil wrote that they do not agree with the nonconformity and the lack of measurement parameters, but that this is an improvement point. They note that the need for maintenance has been greatly reduced, by 73 per cent from November 2010 to October 2011. They state that they prioritise maintenance. The PSA wrote in its response to Statoil that it had reviewed Statoil's response and made a note of it. They state that they will follow up on the activities Statoil describes in 2012.[343]

Follow-up of investigation of steam leak in 2012
Statoil denied many of the regulatory nonconformities in its response to the investigative report. With regard to the improvement point concerning progress in the surface programme, Statoil wrote that they are working to update the programme for the period 2014–2020, and that this work will form a basis for prioritisation within surface maintenance at Mongstad in the next year. Statoil generally expresses that they have a good level of control over maintenance and that they aim to establish acceptable conditions at the facility through the maintenance programme. [344] In its response, Statoil makes no mention of the fact that appropriations for maintenance were halved in the period prior to the incident in 2012. In its letter dated 12 September 2013, the PSA concluded its investigation on the basis of Statoil's response and proposed plans. The PSA noted that activities described in Statoil's response can be added as verification points in later supervision.[345]

Following the audit of management of HSE concerning scaffolding at Mongstad in 2014, Statoil states that it has implemented various measures to address the nonconformities and improvement points noted in the PSA's audit report.[346] The PSA concluded its audit on 7 April 2015, noting that they are taking the company's plans into consideration.[347] The decision to conclude the audit was based on previous correspondence, completed verifications at Mongstad and Statoil's response.

340) Statoil (2010) *Svar på rapport etter gransking av gasslekkasje på Mongstad 8.2.2010* (Norwegian only), letter to the Petroleum Safety Authority, 22 March 2010.
341) Petroleum Safety Authority (2011) *Avslutte gransking av gasslekkasje på Mongstad 8.2.2010* (Norwegian only), letter to Statoil, 21 March 2011.
342) Statoil (2011) *Svarbrev til Petroleumstilsynet etter tilsyn med vedlikeholdsstyring på Mongstad* (Norwegian only), letter to the Petroleum Safety Authority, 2 December 2011.
343) Petroleum Safety Authority (2017) *Oppfølging av tilsyn med vedlikeholdsstyring på Mongstad* (Norwegian only), letter to Statoil, 23 January 2012.
344) Statoil (2013) *Svarbrev til Petroleumstilsynet på granskingsrapport etter damplekkasje 8.11.2012 på Mongstad* (Norwegian only). Letter to the Petroleum Safety Authority, 23 April 2013.
345) Petroleum Safety Authority (2013) *Avslutte gransking etter uønsket hendelse, damplekkasje på Mongstad 8.11.2012* (Norwegian only). Letter to Statoil Petroleum AS, 12 September 2013.
346) Statoil (2015) *Tilbakemelding på kommentarer fra Petroleumstilsynet på rapport etter tilsyn med styring av HMS innen stillas på Mongstad* (Norwegian only), letter to the Petroleum Safety Authority, 20 February 2015.
347) Petroleum Safety Authority (2015) *Avslutning tilsyn med styring av HMS innen stillas på Mongstad — 001902027* (Norwegian only), letter to Statoil, 7 April 2015.

Appendix 6 Review of whether competence requirements are complied with

Requirements for competence are stated in the Public Administration Act. Competence is important in order for the public to have confidence that the authority reaches the right decisions. The PSA has internal guidelines for ethics and competence.[348] The Ministry of Labour and Social Affairs also states requirements for this in the letter of commitment and instructions for the authority.[349]

In accordance with the PSA's internal guidelines, for a period of two years after being hired, new employees may not make a decision or assist in making a decision on any case involving a former employer.[350] To investigate whether employees uphold this competence requirement, information regarding previous employers was obtained for all new employees of the PSA in the period 2013–2017 who carried out audits or verifications, including employees in management positions.

Information about employees' previous employers was obtained from the Register of Employers and Employees, which is administrated by the Labour and Welfare Service. The assessment of whether the competence requirement is upheld is based on information regarding what supervisory activities the individual has participated in. Of a total of 135 employees who work with supervision, 73 were hired after 1 January 2011. Of these, 35 had worked for companies that participate in petroleum activities. These were checked against the supervision database with regard to which companies they had conducted supervision of, and whether this had occurred within the quarantine period. The result of the review showed that none of the 35 had conducted supervision of previous employers within the quarantine period.

In accordance with internal guidelines for competence and requirements from the Ministry, no one employed in the PSA may own shares in companies they conduct supervision of. To investigate whether employees uphold the internal guidelines in this area, share ownership is controlled by comparing the list of employees working in supervision with the shareholder register. The shareholder register contains information about all Norwegian shareholders who own shares in Norwegian companies. The register was last updated at the end of 2017.[351] The review shows that no employees own shares in companies the PSA conducts supervision of.

The PSA notes that it asks new employees about shares and other involvement with companies the PSA conducts supervision of. All employees are also required to self-report. According to the PSA, there is an ongoing obligation to report to one's immediate superior in the event of any changes. The PSA does not carry out any checks, for example in public registries, of this.

348) Petroleum Safety Authority (2017) *Habilitet i Petroleumstilsynet* (Norwegian only). Internal guidelines with appendix, last updated 27 April 2017.
349) Ministry of Labour and Social Affairs (2017) *Letter of commitment 2017 — Petroleum Safety Authority,* 6 January 2017; Ministry of Labour and Social Affairs (2018) *Instruks om virksomhets- og økonomistyring for Petroleumstilsynet* (Norwegian only), 24 May 2018.
350) Petroleum Safety Authority (2017) *Habilitet i Petroleumstilsynet* (Norwegian only). Internal guidelines with appendix, last updated 27 April 2017. Appendix 2.
351) *Shareholder register.* <<https://www.altinn.no/en/start-and-run-business/direct-and-indirect-taxes/the-enterprises-tax/shareholder-register/> [28 August 2018].

23 257 -3 918 240 1 255 712 474 320 120 3 924 22 731

Flisa Trykkeri AS 2018

Office of the Auditor
General of Norway
P.O. Box 6835 St. Olavs plass
N-0030 Oslo

+47 22 24 10 00
postmottak@riksrevisjonen.no
www.riksrevisjonen.no