# REPORT

# Norsok analysis project

Recommendations from the Norsok owners concerning resource commitments and priorities for further work with the Norsok standards.

20 December 2016

Norsk olje&gass

Norsk Industri

Norges Rederiforbund
Norwegian Shipowners' Association

## FOREWORD

Norsok standards are developed by the Norwegian petroleum industry. They are owned by the Norwegian petroleum industry, represented by the Norwegian Oil and Gas Association (Norwegian Oil and Gas), the Federation of Norwegian Industries and the Norwegian Shipowners' Association. The standards are managed by Standards Norway through the sector board petroleum industry. In connection with entering into a new owner agreement (which regulates relationships between the Norsok owners) in April 2015 and a revised commissioning agreement (which regulates the commission from the Norsok owners to Standards Norway) in April 2015, the Norsok owners identified a need to review the ownership portfolio (the Norsok standards). This was the background for initiating the Norsok analysis project.

The purpose of the Norsok analysis project has been to prepare the joint position of the Norsok owners on the Norsok portfolio – in other words, to develop a position on each Norsok standard with regard to future priorities and commitment of resources.

This work has attracted great interest and involvement not only from the Norsok owners' member companies and their employees, but also from other key stakeholders in the field of petroleum standardisation. In addition to the Norsok owners' recommendations and priorities for the Norsok standards, the report describes a number of key issues related to petroleum standardisation. It will hopefully provide a good basis for continued work on petroleum standardisation.

The project's management committee has comprised the following representatives of the Norsok owners, with their dates of membership where relevant:

- Arne Sigve Nylund, 02.09.2015–08.03.2016, Statoil, Norwegian Oil and Gas (operator)
  Anders Opedal, 08.03.2016–25.09.2016, Statoil, Norwegian Oil and Gas (operator)
  Sturle Bergaas, 25.09.2016–, Statoil, Norwegian Oil and Gas (operator)
- Tore Bø, Total, Norwegian Oil and Gas (operator)
- Torjer Halle, Schlumberger, Norwegian Oil and Gas (supplier)
- Astrid Skarheim Onsum, Aker Solutions, Federation of Norwegian Industries
- Hanna Lee Behrens, 02.09.2015–02.06.2016, Norwegian Shipowners Association
  Øyvind Jonassen, 02.06.2016–, Norwegian Shipowners Association
- Hans Petter Rebo, Federation of Norwegian Industries
- Aud Nistov, Norwegian Oil and Gas (project manager)

Many thanks to everyone who has contributed to this substantial job, including the management committee, the project secretariat and not least all the committed and knowledgeable company representatives who have been responsible for the actual evaluation of the Norsok standards.

Stavanger, 20 December 2016

Aud Nistov
Project manager

# 1 SUMMARY

Background
In a global market, the industry will first and foremost work actively for the development and use of international standards. National industry standards, such as Norsok, will cover the identified gap between international standards and the Norwegian requirements where these are the most appropriate. Development and maintenance of standards will thereby contribute to developing and maintaining the Norwegian industry's competitiveness nationally and internationally while allowing it to pursue its operations safely and acceptably.

The petroleum industry, represented by the Norsok owners (Norwegian Oil and Gas, the Federation of Norwegian Industries and the Norwegian Shipowners' Association), collectively supports the following goals for petroleum standardisation:

- ensure an acceptable level of safety
- increase the use of international standards
- reduce the use of special Norwegian requirements
- reduce the need for internal company specifications
- ensure that standards represent cost-effective solutions
- help to strengthen the competitiveness of the Norwegian continental shelf (NCS).

These targets will be achieved by preparing and further developing good technical standards which help to execute development projects and operations professionally and cost-effectively. Common technical standards for production facilities, including drilling units and onshore facilities, will contribute to robust safety, increased value creation, solid cost-efficiency and good quality in the industry. To the appropriate extent, common standards should replace internal company specifications (also called company-specific requirements) at operator and supplier companies.

Norsok standards are developed by the Norwegian petroleum industry and owned by Norwegian Oil and Gas, the Federation of Norwegian Industries and the Norwegian Shipowners' Association. They are managed by Standards Norway through the sector board petroleum industry. In connection with entering into a new owner agreement (which regulates relationships between the Norsok owners) in April 2015 and a revised commissioning agreement (which regulates the commission from the Norsok owners to Standards Norway) in April 2015, a desire arose among the Norsok owners to review the ownership portfolio (the Norsok standards). A need existed to discuss priorities and the use of resource for these standards (including voluntary contributions from the member companies and financial support for Norsok work). This was the background for initiating the Norsok analysis project.

Purpose of the project
The purpose of the Norsok analysis project has been to prepare the joint position of the Norsok owners on the Norsok portfolio – in other words, to develop a position on each Norsok standard with regard to future priorities and commitment of resources. In the management of each Norsok standard by the Standards Norway sector board petroleum industry, the Norsok owners' joint position on the Norsok standards will accordingly represent their recommendations for future action. Decisions on approving, withdrawing or maintaining each Norsok standard will continue to be taken by the sector board, where the following are represented: the Norwegian Confederation of Trade Unions (LO), the Norwegian Union of Energy Workers (Safe), the Norwegian Organisation of Managers and Executives (Lederne), Norwegian Oil and Gas, the Federation of Norwegian Industries, the Norwegian Shipowners' Association, the Petroleum Safety Authority Norway (PSA), DNV GL and Standards Norway.

The project's recommendations

The Norsok analysis project provides recommendations for each Norsok standard. These are summarised in table 2 in chapter 10. The conclusions have been reached on the basis of the project criteria:

- safety level – do the standards contribute to achieving an acceptable level of safety?
- costs – do the standards contribute to cost-effective solutions?
- competitiveness – do the standards encourage industrialisation and efficiency?
- internationalisation – should the standards become international ones?

The Norsok analysis project makes the following recommendations concerning the Norsok owners' portfolio, which totals 75 Norsok standards.

Withdrawn

It is proposed to withdraw a total of 13 Norsok standards.

- E-001 *Electrical systems* – transferred to the Norwegian Electrotechnical Committee (NEK) for follow-up with the International Electrotechnical Commission (IEC).
- M-622 *Fabrication and installation of GRP piping systems* – transferred to ISO 14692.
- M-650 *Qualification of manufacturers of special materials* – transferred to ISO 17782.
- N-002 *Collection of metocean data* – transferred to ISO 19901-1.
- S-005 *Machinery – working environment analyses and documentation* – transferred to Norsok S-002.
- S-006 *HSE evaluation of contractors* – replaced by IOGP 423.
- S-011 *Safety equipment data sheets* – transferred to Norsok S-001.
- S-012 *Health, safety and the environment (HSE) in construction-related activities* – replaced by IOGP 423.
- U-009 *Life extension for subsea systems* – content transferred to Norwegian Oil and Gas guideline 122.
- Y-002 *Life extension for transportation systems* – content transferred to Norwegian Oil and Gas guideline 122.
- Z-014 *Standard cost coding system (SCCS)* – transferred to ISO 19008.
- Z-CR-002 *Component identification system* – transferred to ISO 15926.
- Z-DP-002 *Coding system* – withdrawn because it is no longer in use.

In addition, merging Norsok T-001 *Telecom systems* and T-100 *Telecom subsystems* to form a single Norsok standard is recommended.

This means the Norsok analysis project recommends reducing the Norsok portfolio by a total of 14 standards. However, the content of these standards will be continued through other standards. That will free up administrative resources which can be redirected to other standards.

Norsok standards given a high priority for "internationalisation"

The Norsok analysis project has identified four Norsok standards which could be appropriate to prioritise for proposing as international standards. Their common denominator is that no existing international standards fully cover the corresponding discipline. In addition, the Norsok analysis project has become aware that these standards are already in widespread use outside Norway. This applies to the following standards.

D-010 *Well integrity in drilling and well operations*
Z-001 *Documentation for operations (DFO)*
Z-013 *Risk and emergency preparedness assessment*
Z-018 *Suppliers' documentation of equipment*

That means the Norsok analysis project proposes (within a relatively short time frame) reducing the Norsok portfolio by a total of 18 standards. This corresponds to about a quarter of the portfolio which formed the starting point for the project.

"Internationalisation" in the longer term

It is recommended that the remaining portfolio of 57 Norsok standards be retained, but that active efforts should be made in the longer term to propose a number of Norsok standards as international standards – either wholly or in part. However, this would depend on ensuring that the international standard does not become a compromise which weakens requirements for acceptable safety and/or would need to be supplemented by company-specific requirements. The goal of Norwegian petroleum standardisation must be to limit the need for company-specific requirements.

In addition, it will be relevant to propose parts of a number of Norsok standards as improvements to existing international standards. Priorities for such work are governed by when the relevant international standard comes up for revision.

Priority commitment

The Norsok-analysis project recommends a priority commitment in the following areas.

1. Z standards on technical information (Z-001, Z-003, Z-004, Z-005 and Z- 018).
   Revision of these standards is given the highest priority. Z-001 and Z-018 should also receive high priority as a basis for international standardisation.
2. S-002 covering working environment requirements.
   Revision of this standard is given the highest priority.
3. R standards on lifting equipment (R-002, R-003 and R-005).
   Revision of these standards is given the highest priority.
4. L standards dealing with piping (L-001 and L-CR-003).
   Revision of these standards is given high priority.
5. Z-008 on risk-based maintenance and consequence classification.
   Revision of this standard is given priority.
6. Z-013 on risk and emergency preparedness assessment.
   Revision of this standard is given the highest priority. Z-013 should also receive high priority as a basis for international standardisation.
7. S-003 on environmental care.
   Revision of this standard is given priority.
8. U-001 on subsea production systems.
   Revision of this standard is given priority.
9. Z-015 on temporary equipment.
   Revision of this standard is given priority.
10. I-005 on system control diagram.
    Revision of this standard is given priority.
11. S-001 on technical safety.
    Revision of this standard is given priority.
12. N-005 on condition monitoring of loadbearing structures.
    Revision of this standard is given priority
13. M-004 on material
    Revision of this standard is given priority.
14. D-010 on well integrity in drilling and well operations.
    Revision of this standard is given the highest priority. D-010 should also receive high priority as a basis for international standardisation.

Competence and training requirements

A small number of Norsok standards contain requirements on competence and training. Whether Norsok standards should incorporate such requirements has been questioned as a matter of principle. Since some of the standards which specify competence and training requirements are also referenced in the HSE regulations, these requirements are interpreted as virtually binding in normative terms.

The project recommends that competence and training requirements in Norsok standards should be:

- limited to a minimum.
- entrenched as a requirement with the Norsok owners
- formulated as performance-based ("functional") requirements.

Furthermore, the Norsok analysis project recommends that Norsok standards should not contain:

- requirements specified in a corresponding form in an international standard
- certification requirements or requirements for certification of course providers
- training requirements in the form of courses or course implementation outside the company.

Nor should competence requirements be repeated in a Norsok standard if identically worded provisions are incorporated in Norwegian regulations.

Requirements related to management in a company, operational conditions and contractual relations

Certain Norsok standards contain requirements for operations-related conditions. Various stakeholders have argued that the Norsok standards should be confined to design, systems, structures and so forth, while provisions which describe operational procedures and/or management in a company should be avoided. Similar discussions have occurred in relation to provisions which describe management and requirements for contractual relations.

The Norsok analysis project recommends that requirements for operational conditions in Norsok standards should be carefully assessed before being adopted. Requirements concerning company management in Norsok standards should be avoided. So should requirements for contractual relations in Norsok standards.

Development and formulation of Norsok standards

All work related to Norsok standards must conform to Norsok A-001N *Guidelines on developing and formulating Norsok standards* (4), including the establishment, revision and withdrawal of Norsok standards.

Further work

The Norsok owners will follow up the positions developed for the various Norsok standards through the Norsok analysis project, which are presented in chapters 10 and 11 of this report as well as in appendix A. This work will be pursued through the sector board petroleum industry, through increased management attention and resource allocation by the Norsok owners' member companies, and through other industry initiatives.

One such initiative is KonKraft. This is a collaboration arena for Norwegian Oil and Gas, the Federation of Norwegian Industries, the Norwegian Shipowners' Association and the Norwegian Confederation of Trade Unions (LO) as well as the United Federation of Trade Unions and the Norwegian Union of Industry and Energy Workers, which are both LO members. KonKraft is intended to be an agenda-setter for national strategies in the petroleum sector and to work to maintain the competitiveness of the NCS so that Norway remains an attractive area for investment by the Norwegian and international oil and gas industry – including supplier companies and the maritime industry. KonKraft recently launched a new initiative on *Competitiveness – the changing NCS*. This will pursue such issues as standardisation, simplification and industrialisation.

The goal of the original Norsok process in the 1990s was to cut the number of company-specific requirements and to reduce time and costs for development and operation. This objective has largely been achieved. The Norsok analysis project shows that corresponding targets have been met through Norsok work over the past 10-15 years. It has thereby demonstrated that the claim "Norsok standards drive up costs" cannot be substantiated for the industry as a whole.

Norsok standards reflect the expertise and experience accumulated by petroleum activities on the NCS over 50 years. The Norsok analysis project shows that the development and adoption of Norsok standards have contributed to the competitive standing of the NCS, to successful development projects, and to safe and acceptable operation.

## 2 INTRODUCTION

The terms “standardisation”, “standards” and “petroleum standardisation” are used by many different players in a variety of connections. Great variations often emerge in the understanding or interpretation of these concepts.

Standardisation can best be described with the aid of ***ISO/IEC Guide 2:2004*** *(1):*

Standardization:
Activity of establishing, with regard to actual or potential problems, provisions for common and repeated use, aimed at the achievement of the optimum degree of order in a given context.

NOTE 1 In particular, the activity consists of the processes of formulating, issuing and implementing standards.

NOTE 2 Important benefits of standardization are improvement of the suitability of products, processes and services for their intended purposes, prevention of barriers to trade and facilitation of technological cooperation.

Standardisation can accordingly be understood as the act of developing and implementing standard technical solutions. The latter can apply at different levels, such as components, individual items of equipment, skid packages or complete systems.

“Standardisation” in this report primarily means technical specifications, but standardisation in other areas may be important in order to secure safe and cost-efficient development and operation. Examples could include contractual conditions and sets of terms for development projects or operation, conditions in frame agreements, standard documentation for standard equipment and so forth.

The formal definition of the word “standard” is:

Document, established by consensus and approved by recognized body, that provides, for common and repeated use, rules, guidelines or characteristics for activities or their results, aimed at the achievement of the optimum degree of order in a given context.

This definition is taken from ***NS-EN 45020:2006***, section 3.2 (2) and ***ISO/IEC Guide 2:2004***.

A standard can also be described in other ways. Some criteria are listed below. A standard:

- is prepared at the initiative of interest groups
- provides guidelines on which requirements are to be set for goods and services
- regulates how sampling, certification and accreditation are to be conducted
- is a proposed choice of solution
- contributes to the development of safe and appropriate products, production processes and services
- is often applied on a voluntary basis
- provides more detailed descriptions of EU directives or national legislation and regulations.

The ISO definition of a standard is:

Standards bring technological, economic and societal benefits. They help to harmonize technical specifications of products and services making industry more efficient and breaking down barriers to international trade. Conformity to International Standards helps reassure consumers that products are safe, efficient and good for the environment.

Industrialisation can be described as follows:

Use repetitive manufacturing processes for products or processes to obtain learning curve effects for increased efficiency and reduced cost levels.

One goal for all standardisation work is a set of good standards which can replace most company specifications. The alternative to common technical standards is that each company sets its own technical requirements. This is expected to drive up costs, both for the individual company – particularly small and medium-sized ones – and for the industry overall.

Although the ultimate aim of standardisation work should be a set of good international standards, all common standards (whether Norsok, CEN, ISO, API, or others) will nevertheless contribute in virtually all cases to cost cuts. Time and costs will be saved by having common technical requirements which as many operators and suppliers as possible can support. A cost saving will also be achieved through continuous simplification when replacing inappropriate, detailed and cost-driving special requirements with performance-based alternatives. This permits more reuse of concepts, less extensive documentation, fewer "tailored" solutions and more economies of scale. In addition, common technical standards contribute to more robust safety through the use of standard concepts which represent accepted and tested solutions.

Norsok standards are developed by the Norwegian petroleum industry. They are owned by the Norwegian petroleum industry, represented by the Norwegian Oil and Gas Association, the Federation of Norwegian Industries and the Norwegian Shipowners' Association. The standards are managed by Standards Norway through the sector board petroleum industry. In connection with entering into a new owner agreement (which regulates relationships between the Norsok owners) in April 2015 and a revised commissioning agreement (which regulates the commission from the Norsok owners to Standards Norway) in April 2015, the Norsok owners identified a need to review the ownership portfolio (the Norsok standards). This requirement related first and foremost to discussions about priorities and the use of resources for these standards (including voluntary contributions from the member companies and financial support for Norsok work). This was the background for initiating the Norsok analysis project.

The purpose of the Norsok analysis project has been to prepare the joint position of the Norsok owners on the Norsok portfolio – in other words, to develop a position on each Norsok standard with regard to future priorities and commitment of resources. In the management of each Norsok standard by the Standards Norway sector board petroleum industry, the Norsok owners' joint position on the Norsok standards will accordingly represent their recommendations for future action. Decisions on approving, withdrawing or maintaining each Norsok standard will continue to be taken by the sector board.

Petroleum standardisation is a complex activity. It has accordingly been necessary to acquire information about such aspects as the history, management and development of petroleum standardisation, the relationship between HSE regulations and the Norsok standards, international petroleum standardisation in order to provide the basis for a good grasp of what petroleum standardisation actually is. That is covered in this report from chapter 3 to 8. A description of the Norsok analysis project follows in chapter 9, while results from the project are presented in chapter 10 and appendix A. Chapter 11 lists the project's recommendations concerning the Norsok owners' priorities for continued work on petroleum standardisation.

Finally, it must be emphasised that both chapters 10 and 11, as well as appendix A, present the Norsok owners' position on and recommendations concerning future priorities and the use of resources for petroleum standardisation. These will be the Norsok owner's recommendations to Standards Norway's sector board petroleum industry. Decisions relating to petroleum standardisation, including both international and Norsok standards, will be taken by the sector board.

# 3 NORWEGIAN PETROLEUM STANDARDISATION – A HISTORICAL OVERVIEW

Activity in the petroleum sector on the NCS during the early 1990s was characterised by low oil prices, high costs and great uncertainty over the future resource base. High rig rates also affected the sector.

At the same time, the Asian crisis was beginning to affect the world economy. Oil prices fell to about USD 10 per barrel. This sent a strong signal to the petroleum industry that costs had to be cut to make fields profitable.

The industry also experienced big cost overruns in development projects. Against that background, the government appointed a committee of inquiry chaired by Professor Knut Kaasen. The whole Norwegian petroleum sector, including the government, was keen to find solutions which could help to improve profitability.

In the summer of 1993, the minister of industry and energy took the initiative to establish a development and production forum for the petroleum sector. This comprised representatives from eight oil companies and eight suppliers, the LO, the Norwegian Petroleum Directorate (NPD) and four civil servants from the ministry. Chaired by Norsk Hydro, its executive committee had Statoil, BP, Aker, Reinertsen and Smedvig as members. The NPD and the ministry also participated in this committee. The basis for the competitive standing of the NCS (Norsok) was thereby laid. The ministry appointed a management committee and seven work groups to prepare specific proposals on cost-cutting measures in key areas.

Work group 2 was to focus on issues related to standardisation with the following mandate:

The mandate is to prepare a set of common technical standards for drilling and production facilities for oil and gas. These standards will contribute to substantial savings in cost and time.

The industry did not feel that the international standards available in the early 1990s met its requirements. One consequence of this during the decade was a rapid and relatively extensive development of internal company requirements.

Work group 2's mandate aimed at the preparation of a new set of common standards for the most important disciplines. This work was to be completed by the end of 1994. These new standards were to replace the many and varied internal company specifications which each operator administered at the time. The first drafts for new standards were largely prepared by the three Norwegian oil companies at the time (Statoil, Hydro and Saga Petroleum) on the basis of their existing specifications.

***Competitive standing of the NCS – Norsok – sub-report 2 – standardisation*** (3), drawn up by work group 2, was submitted to the Ministry of Industry and Energy on 1 February 1995.

A total of 88 Norsok standards were developed in the categories design principles (9), common requirements (33) and specific system requirements (46).

The work group's report stated:

The key to improvement lies primarily with the oil companies themselves, whether the activity is governed by the oil companies alone, by relations with suppliers, or by relations between labour unions. The oil companies must take responsibility for providing the initiative and drive behind the recommendations. That applies particularly in collaborative relationships (including within licence groups and with suppliers). And the willingness to accept the solutions and standards of others for the common good.

A collaboration between key players in the sector, including cooperation between oil companies and suppliers, was seen as essential for the success of future work.

The goal of developing the new standards was ultimately to establish a set of good international standards which could replace both most Norsok standards and other company specifications. As a result, the work group recommended that the oil and supplies industries should prioritise the allocation of competent people who could work actively to get relevant parts of the Norsok standards incorporated in the ISO standards. The remaining content in the Norsok standards should be subject to a critical evaluation in order to retain only those parts which were absolutely necessary for the Norwegian petroleum industry.

These new industry standards were intended to help achieve cost cuts of 25-30 per cent (on purchases of the specified equipment) in the initial projects, and 40-50 per cent over a period of four-five years. Particular attention was paid to two areas:

- common technical requirements which would be adopted by the largest possible number of operators and suppliers, and which would provide a new offshore industry standard to save time and money
- a considerable simplification by replacing existing detailed and cost-driving special requirements with performance-based specifications.

The proposals in ***Norsok – sub-report 2 – Standardisation*** were largely implemented by the companies, and cost reductions of about 40 per cent are said to have been achieved. Examples of projects which applied these principles include Visund, Troll C, Grane, Njord and Oseberg. Put a little simply, it can be argued that these results are attributable to the introduction of the engineering, procurement and construction (EPC) model, which led among other benefits to a reduction of roughly one year in execution time.

Kvitebjørn was one of the few fields to be sanctioned for development in the late 1990s. Norwegian fabricators proved to have adapted quickly to the new times, and domestic industry won all the Kvitebjørn contracts. This development resulted in costs below the levels witnessed earlier in the 1990s. That reflected a combination of industry adjustments to low oil prices and the effect of the recent introduction of Norsok.

Important conditions for reducing the total cost of new developments on the NCS by 40-50 per cent (with reference to the goal of the ***competitive standing of the NCS*** initiative) by adopting the Norsok standards were:

- common standard design/technical requirements
- considerable reuse of standardised supplier equipment which complied with international standards
- that all quality requirements would be “good enough”
- that the leading position of the NCS for health, safety and the environment was maintained.

The Norsok standards are unique in that they were developed on the basis of broad expertise, good collaboration and long experience from the NCS. This mode of working builds on the Norwegian collaboration model.

# 4 MANAGEMENT AND DEVELOPMENT OF NORSOK STANDARDS

## 4.1 History

Work group 2, which was responsible for standardisation in the initiative on ***the competitive standing of the NCS – Norsok*** (see chapter 3), recommended that the Norwegian Oil Industry Association (OLF – now Norwegian Oil and Gas) and the Federation of Norwegian Manufacturing Industries (TBL – now the Federation of Norwegian Industries) should establish a formal collaboration for ownership, distribution, maintenance and preparation of Norsok standards.

An agreement was entered into in 2000-2001 between the OLF and the forerunner of Standards Norway on management of the Norsok standards.

## 4.2 Ownership and administration

Norsok standards are developed by the Norwegian petroleum industry. They are owned by Norwegian Oil and Gas, the Federation of Norwegian Industries and the Norwegian Shipowners' Association, and managed by Standards Norway. Bothe the owner agreement and the commissionin agreement were signed 15 April 2015. Roles and responsibilities are regulated through the owner agreement, the commissioning agreement and the annual letter of award from the owners to Standards Norway.

## 4.3 Copyright

Participants in the expert groups or the standardisation projects hold the copyright for their own contribution to the standard's content if this is of such a character that copyright provisions apply. The owners have the copyright to the Norsok standards, while Standards Norway manages the Norsok brand name on behalf of the owners.

## 4.4 Sector board petroleum industry

The sector board petroleum industry is appointed by the Standards Norway board and serves as a link between Standards Norway, the owners and the users of the petroleum standards.

Responsibilities of the sector board are to lead standardisation activity in the Norwegian petroleum industry, including the determination of strategy, work programme and budget, contribute to securing finance, help to facilitate necessary company contributions/voluntary resources, allocate personnel resources, approve new and revised Norsok standards, and propose new or contribute suggestions for revisions of international standards.

The following are represented on the sector board petroleum industry: Norwegian Oil and Gas (chair and three members), the Federation of Norwegian Industry (deputy chair and three members), the Norwegian Shipowners Association (two members), DNV GL (one member), Safe (one member), LO (one member), Lederne (one member), PSA (one member) and Standards Norway (one member).

## 4.5 Business manager petroleum standardisation

The business manager for petroleum standardisation in Standards Norway leads its secretariat for the petroleum area. This person serves as the secretary of the sector board petroleum industry and reports on the status and progress of its activity.

## 4.6 Secretariat in Standards Norway

The secretariat's job is to manage and facilitate standardisation work for the petroleum area in Standards Norway within the specified disciplines in line with the strategy, action plans and budgets adopted by the sector board petroleum industry. That includes relevant international activities and the Norsok industry standards.

## 4.7 Expert groups

The members and chairs of expert groups are technical specialists from the Norwegian petroleum industry, selected in collaboration with Standards Norway. Their job is to develop and revise the individual standards and to look after the industry's interests in the specific disciplines. Through standardisation work, suppliers and clients develop a necessary sense of industry community. Participants acquire a common "language" and can discharge common tasks.

Each standard is considered in the relevant expert group under the direction of Standards Norway. A group's mandate provides guidance on how it is to work on petroleum standardisation related to Norsok standards. The expert groups will:

- work on assignments from the sector board petroleum industry
- work in accordance with the mandate for each assignment approved by the sector board petroleum industry
- work in accordance with ***Norsok A-001N – Guidelines on developing and formulating Norsok standards*** (4)
- define requirements ("shall") in the standards
- ensure that requirements are grounded in cost/benefit considerations on the basis of production efficiency, and in possible risk-reducing effects in order to help achieve an acceptable level of safety
- be based on international and European standards in order to choose between options and selected supplements to these standards
- specify performance-based requirements and recommendations in order to achieve standardised solutions which limit variations in systems, interfaces and components
- specify prescriptive requirements and recommendations if these are cost-effective and provide an acceptable level of safety
- contribute to reducing the need for company-specific requirements
- express clear requirements or requirements, and be short and concise
- develop standards in line with the slogan "good enough is good enough"
- be a starting point for developing international standards, based on expertise from safe and cost-effective operation on the NCS.

Technical specialists participating in expert groups provide their efforts free of charge, which means that the cost of this substantial industry contribution is covered by the companies.

## 4.8 Petroleum standardisation – roles and processes

The relationship between the various roles and processes for petroleum standardisation is illustrated in figures 1 and 2.

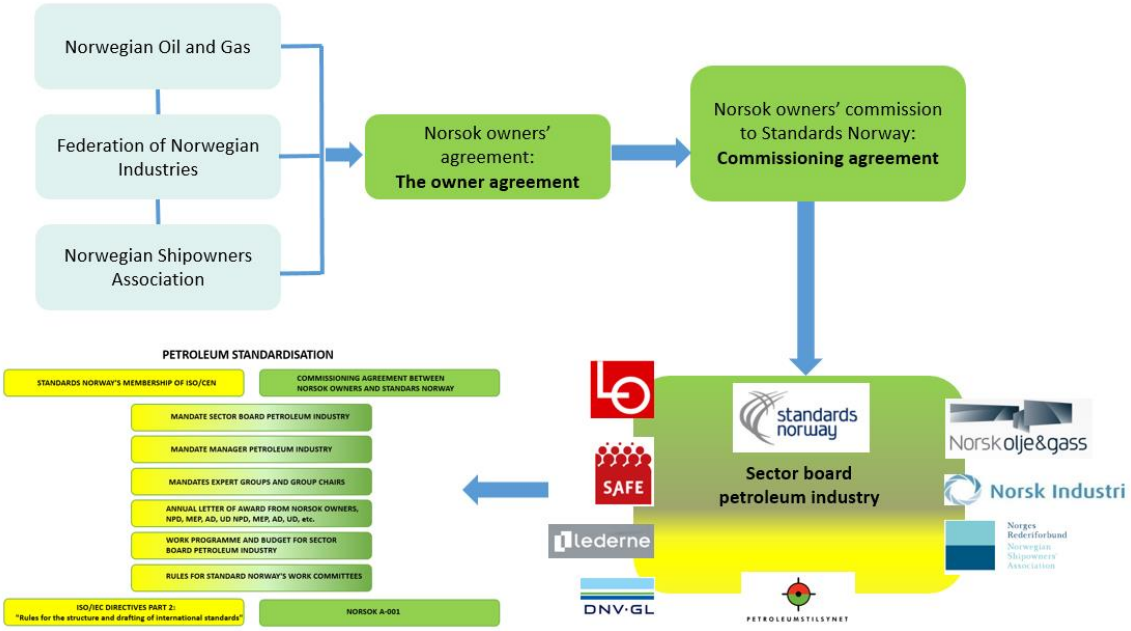



Figure 1 – Players' roles and agreements for petroleum standardisation.

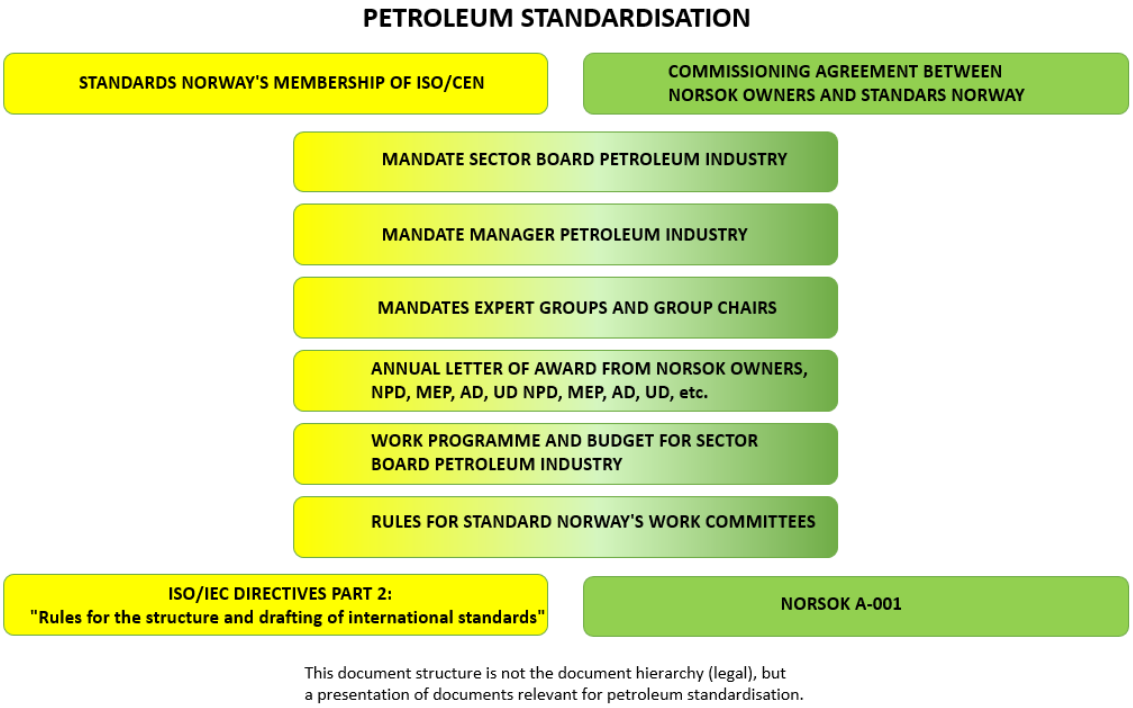



Figure 2 – Description of roles and key documents in petroleum standardisation for Norsok processes (green) and international petroleum standardisation (yellow).

## 4.9 Norsok A-001N – Guidelines for developing and formulating Norsok standards

***Norsok A-001 –Guidelines for developing and formulating Norsok standards*** is a separate Norsok directive (in Norwegian only) which describes sub-activities and methodology for developing and formulating Norsok standards, including the establishment, revision and withdrawal of Norsok standards.

See the link to Norsok A-001N (in Norwegian only):
http://www.standard.no/Global/PDF/Petroleum/2016-06-27%20Norsok_A-001_2016%20Final%203.pdf

Figure 3 presents the phases and activities involved in preparing Norsok standards at an overarching level. The various phases for establishing, revising and withdrawing a Norsok standard are based on the corresponding phases in ISO. The figure also describes the procedure for initiating work on international standards in ISO.

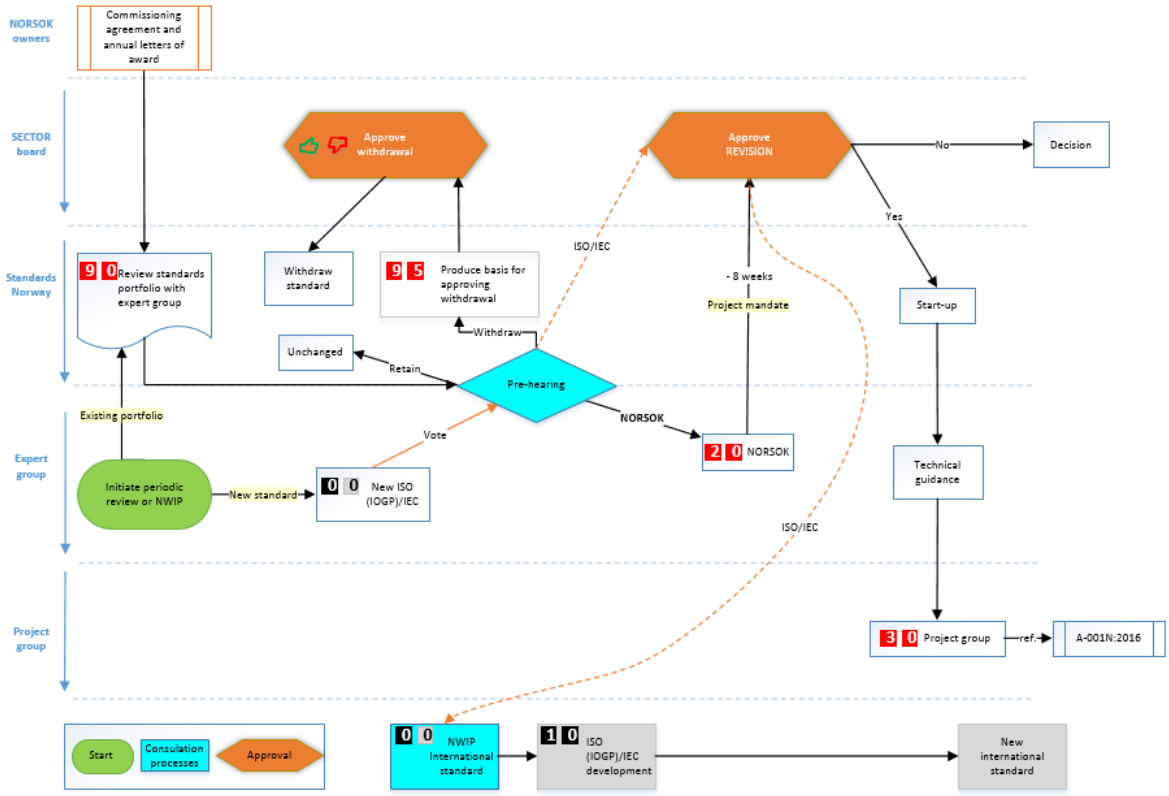



Figure 3 – Project phases for establishing, revising and withdrawing Norsok standards and a description of the procedure for initiating work on international standards in ISO. (Source: Norsok A-001N)

## 4.10 Financing petroleum standardisation in Norway

Petroleum standardisation in Norway (both Norsok standards and Norwegian contributions to international petroleum standards) is financed through a collaboration between the petroleum industry and the Norwegian government. Figure 4 presents financing for 2016.

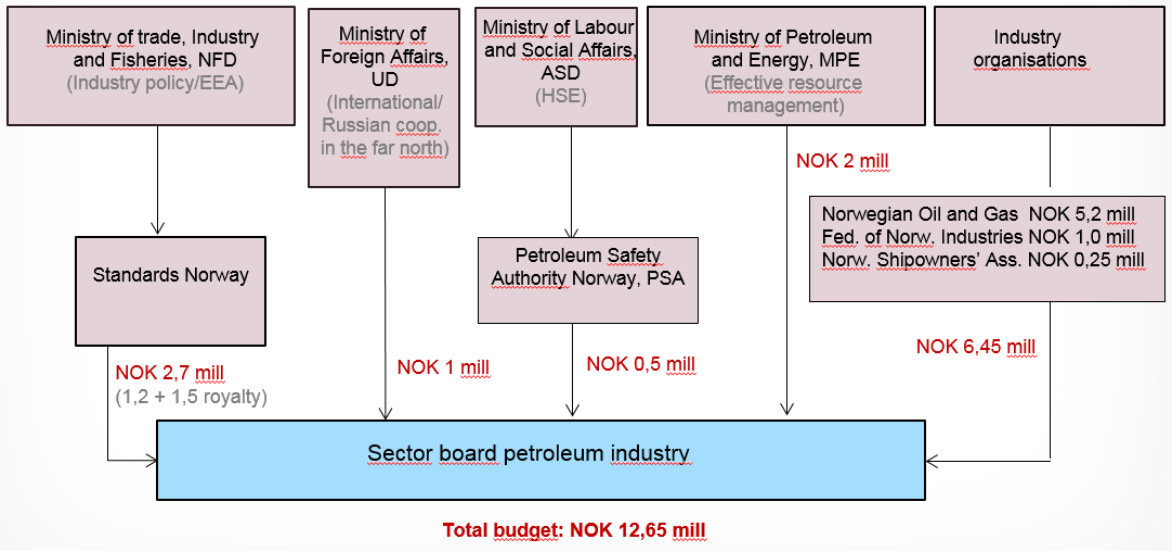



Figure 4 – Financing petroleum standardisation in 2016. The total budget is NOK 12.65 million excluding self-funding in the order of NOK 30 – 50 million per annum. (Source: Standards Norway)

Direct financial contributions to petroleum standardisation presented in figure 4 are supplemented by self-funded work on standardisation by the industry estimated to be worth almost NOK 30 – 50 million per annum.

# 5 DEVELOPMENT OF NORSOK STANDARDS FROM 1994 TO THE PRESENT DAY

The underlying intention for the Norsok standards was that they would be an "interim" solution, with the long-term goal of incorporating them in or transforming them into ISO standards, and thereby replacing most Norsok standards and other company specifications.

Since the Norsok standards were established, two major comparisons or gap analyses have been conducted between Norsok and international standards.

## 5.1 Norsok Standards – Qualifications and Gap Analysis versus International Standards

A gap analysis was conducted in 2002 by Aker Kværner Engineering and the Norwegian Technology Centre (NTS) under the title ***Norsok Standards – Qualifications and Gap Analysis versus International Standards.*** (5)

The report can be briefly summed up as follows:

It is believed that *Norsok – Qualifications and Gap Analysis versus International Standards* and the results achieved can be utilised by Norwegian industry as follows:

- A reduction in the number of Norsok standards
- The content of the Norsok standards can be reduced to what is absolutely required on the Norwegian continental shelf
- Norwegian industry can get an awareness of the difference between Norwegian and international requirements with the possible results of:
    - Optimisation of Norwegian requirements, possibly with cost reductions
    - Norwegian industry is in a better shape to understand international requirements so as to make the industry more competitive on an international marked
- The analysis have established an overview of the status of the Norsok standards as seen from a Norwegian contractor, which hopefully can be used to established necessary work required for the standardisation of Norsok standards and possible adoption into ongoing ISO/CEN standardisation work.

## 5.2 Plan for implementation of Norsok standards into the international standards work

A similar study was conducted by Statoil i 2009 under the title ***Plan for implementation of Norsok standards into the international standards work.*** (6)

The conclusions in this report do not differ significantly from the work done in 2002.

## 5.3 Development of the Norsok standards

From 2002 to 2014, apart from a short period around 2009, the industry experienced high and rising oil prices, which eventually appeared to divert some attention from reducing field development costs and thereby also from the intention that Norsok should be an instrument for achieving this.

Over the 22 years from 1994 to 2016 – in other words, during the period from the establishment of the Norsok standards until the present day – the Norsok portfolio has undergone major changes.

When the Norsok portfolio was established in 1994, it contained 88 standards.

However, a total of 182 Norsok standards have been developed over the 22-year period. These have had the following history.

39 have been replaced by other standards.

48 have been incorporated in other standards. That applies, for example, to a number of standards for drilling and process systems where separate standards previously existed for each system.

18 have been fully replaced by ISO or DNV GL standards or recommended practices (RPs). A number of ISO standards have accordingly been developed on the basis of original Norsok standards.

Two have been withdrawn and not replaced.

In addition, a number of Norsok standards have contributed a substantial part of their content to establishing ISO standards but have been retained with special Norwegian content which has not been relevant or not received support internationally.

When the Norsok analysis project kicked off in the first quarter of 2015, a total of 75 Norsok standards existed. These have formed the basis for the project, and are the ones covered by this report.

# 6 RELATIONSHIP BETWEEN HSE REGULATIONS AND NORSOK STANDARDS

Reference is made to ***White Paper no 51 (1992–1993) – on safety and the working environment in petroleum activities on the NCS*** (7):

When framing its regulations, the Norwegian Petroleum Directorate has assumed that it will make the greatest possible use of recognised norms as an alternative to developing its own detailed requirements in the area. This will save resources while highlighting and facilitating the industry's responsibility for establishing detailed norms for its activity.

The government wished to shift the HSE regulations away from prescriptive to more performance-based requirements. The result was a major regulatory change which took effect on 1 January 2003. That means the PSA's work as a regulator has been simplified. Where the industry is concerned, standardisation work provides a unique opportunity to exert influence at a detailed level and thereby yields greater predictability.

Norsok standards could be used as references in the government's performance-based regulations. This was formalised in letters exchanged between the NPD (now the PSA) on the one hand and the OLF and the TBL on the other.

***Crown Prince Regent's decree of 19 December 2002 on the establishment of the Petroleum Safety Authority Norway*** (8) specifies:

- authority is delegated to the PSA to establish more detailed regulations for safety and the working environment in the activity
- appendices to the resolution, the coordination instruction, provide more details about such aspects as principles for formulating regulations and their follow-up.

Furthermore, the resolution describes coordinated and integrated HSE regulations:

As far as is possible and appropriate, the regulations will be formulated in such a way that the government determines the framework for acceptable health, safety and environmental conditions. In order to provide the necessary predictability, performance-based requirements will be amplified by references to detailed standardisation specified in recognised norms, including industry standards or guidelines prepared by the authorities.

## 6.1 Section 24, framework regulations

The HSE regulations are to a great extent performance-based today. Such requirements generate a need for norms. The government recommends the use of norms (including standards) in the guidelines to the regulations. Industry standards (including Norsok standards) and corresponding standards/norms are recognised by the regulator when the regulations refer to these. Recommended norms/standards meet the intentions in the regulatory requirements – in other words, what qualifies as acceptable fulfilment of the requirements. This is regulated specifically in **section 24 of the *framework regulations*** (9):

When the responsible party makes use of a standard recommended in the guidelines to a provision of the regulations, as a means of complying with the requirements of the regulations in the area of health, safety and the environment, the responsible party can normally assume that the regulatory requirements have been met.

When other solutions than those recommended in the guidelines to a provision of the regulations are used, the responsible party shall be able to document that the chosen solution fulfils the regulatory requirements. Combinations of parts of standards shall be avoided, unless the responsible party is able to document that an equivalent level for health, safety and the environment can be achieved.

Existing documentation, including maritime certificates issued by Norwegian or foreign flag state authorities, can be used as a basis to document compliance with requirements stipulated in or in pursuance of these regulations.

## 6.2 Guidelines to the HSE regulations

The guidelines contain more detailed descriptions of how the regulatory requirements are to be understood, along with references to selected standards as a recommended way of complying with the relevant regulatory requirement.

This makes demands on the formulation of the standards. If the standards are formulated in such a way that they are performance-based, several ways of complying with the regulatory requirements could be provided. Should the standards be prescriptive, however, it can be difficult to meet the regulatory requirements if approaches which differ from the one specified in the standard are chosen. Genuine freedom of choice means in part that the cost of documenting an alternative solution must not be disproportionate. If freedom of choice is not genuine, the standard will in practice be as binding as prescriptive regulation.

## 6.3 References to Norsok standards and other norms in the HSE regulations

The HSE regulations refer to a number of different standards, including Norsok, ISO, IEC, API and DNV GL standards. These references appear in the guidelines to the regulations. Where table 1 refers to a regulation, the reference is to that regulation's guidelines. The HSE guidelines have the following references:

- ***the framework regulations*** (9) make no references to norms
- ***the management regulations*** (10) primarily utilise management standards in the ISO 9000 family, but also refer to a number of different standards
- ***the facilities regulations*** (11) refer to a number of different standards
- ***the activities regulations*** (12) refer to a number of different standards.

Table 1 – Overview of references in the HSE regulations

| **References in the HSE regulations** | **Management regulations** | **Facilities regulations** | **Activities regulations** |
|---|---|---|---|
| IEC | 2 | 5 | 3 |
| ISO | 10 | 17 | 5 |
| **Norsok** | **7** | **36** | **13** |
| API | | 1 | 1 |
| DNV GL | | 15 | 4 |
| NS-EN | | 4 | 1 |
| NS | | 9 | 6 |
| Imaca | | 1 | 1 |
| IMO | | 4 | 1 |
| NT | | 2 | |
| NR | | 1 | |
| Gomo | | | 1 |
| EDTC | | | 1 |
| Total | 19 | 95 | 37 |

Norsok standards are by far the most frequently cited norms in both the facilities (36 of 98 references) and the activities (13 of 45 references) regulations.

## 6.4 The PSA's role in petroleum standardisation

Norwegian Oil and Gas has had a number of conversations and meetings with the PSA's management during 2015 concerning the authority's role in Norwegian petroleum standardisation work. Through these conversations, the PSA's management has explained that the authority's involvement in standardisation work related to the Norsok standards is to be regarded as an observer role.

Norwegian Oil and Gas has submitted the following description of the PSA's role in writing to the PSA management, and the PSA has had no objections to this presentation:

The role of the PSA in relation to petroleum standardisation is to be understood as follows:

- The PSA participates as an observer in relevant fora in petroleum standardisation, including the sector board petroleum industry and Norsok expert groups (and possible associated work groups).
- The PSA may participate in meetings held in the relevant fora. At these meetings, the PSA can promote its interests by participating in the discussions which take place. The PSA can express its views on equal terms with all other participating interests.
- However, the PSA's representatives cannot serve as secretary for or play leading roles in any part of the petroleum standardisation work conducted under the auspices of Standards Norway (understood as the development and revision of Norsok standards).
- The PSA's representative(s) are not able to participate in possible voting related to Norsok standards.

However, different understandings of roles appear to exist in the PSA. The following appears in a presentation given by the authority:

The government's references to standards in the regulations simplify regulatory work. Standardisation work provides a unique opportunity to exert influence at the level of detail, and provides better predictability and competitive advantages.

The statement "Standardisation work provides a unique opportunity to exert influence at the level of detail …" could be interpreted to mean that PSA pursues regulatory development outside the established arenas for regulatory work.

However, the Norsok owners assume that, unless the PSA conveys a different position in writing to the sector board petroleum industry, the PSA's role in connection with Norsok work is as an observer.

Norwegian Oil and Gas received 13 December 2016 a response from the PSA:

The PSA's participation in standardization work initiated and implemented by the parties or the industry itself is part of our role. Our involvement will depend on the nature of the work, the type of committee and working group.

PSA is through the performance-based regulations and referrals to recognized standards an important user of standards regarding the framework-setting and professional work. We are a corporate member of Standards Norway and is a voting member of the Standards Norway supervisory board. We look at the sector board petroleum industry as an important tri-party arena, and we want to strengthen our participation in this forum as we have proposed to increase our participation from one to two members. We are awaiting a discussion about this proposal in the sector board petroleum industry. But we anticipate our board members to have the right to speak, the right to put forward proposals and the right to vote.

In the expert groups in which the PSA participates, the PSA will act as an observer. However, this implies that we will participate in the discussions and contribute with our expertise in dealing with the different standards as relevant.

# 7 INTERNATIONAL STANDARDS

The oil and gas sector in Norway has been characterised in part by the development and adoption of technology at a rapid pace, by big investments, by a long-term time frame for capital spending, by large and complex projects, and by its high level of expertise. However, both business models and the player picture are changing, and both oil companies and suppliers cover a wide size range. A number of companies have their own global systems for project execution, standards and contracts, while others rely to a much greater extent on industry standards as well as supplier solutions and expertise.

In a global market, the industry will first and foremost work actively for the development and application of international standards. National industry standards, such as Norsok, are intended to fill the gap between international standards and Norwegian requirements – but only where this is most appropriate in terms of costs, efficiency or specific national conditions (related, for example, to regulations and climatic conditions). Development and maintenance of good standards will also contribute to developing and maintaining the Norwegian industry's competitiveness nationally and internationally.

## 7.1 International petroleum standardisation – process

ISO and the CEN account for the international standardisation work or standards which are primarily relevant for the oil and gas industry in Norway.

ISO standards are developed and managed by the International Organisation for Standardisation (ISO), with petroleum standards managed by ISO technical committee 67 – materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries (ISO TC 67).

The ISO's members are states – in other words, Norway is a member, not the individual companies. Standards Norway manages Norway's ISO membership. Member states nominate technical experts to participate in the various technical committees. Technical experts from the companies can participate as their country's participants in the various committees.

The process for developing, revising and withdrawing ISO standards requires that a proposal for a new ISO standard has the support of at least five member states before a start to work can be accepted and implemented. The process for developing ISO standards is shown in figure 5.

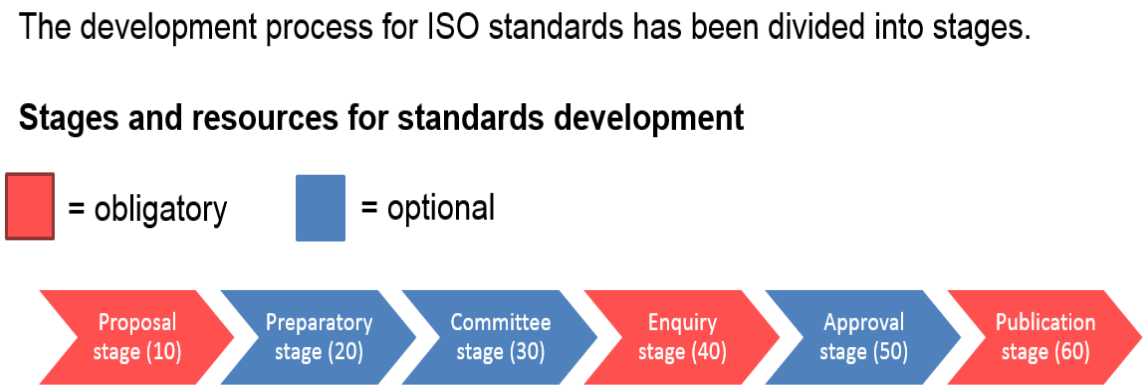



Figure 5 – Development of ISO standards. (Source: ISO)

European standardisation is organised in the European Committee for Standardisation (CEN), the European Committee for Electrotechnical Standardisation (Cenelec) and the European Telecommunications Standards Institute (Etsi). Europeaen petroleum standards are managed by CEN technical committee 12 (CEN TC 12). Regulation no 1025/2012 regulates EU collaboration between the European standardisation bodies, the national standardisation organisations, the European Economic Area (EEA) countries and the European Commission.

Much of the regulation has already been applied to Norway through its three national standardisation institutions: Standards Norway, the Norwegian Electrotechnical Committee (NEK) and the Norwegian Telecommunications Authority (Nkom). These belong to the CEN, Cenelec and Etsi respectively. As members of these European standardisation bodies, national standardisation organisations must implement all European standards and adopt them as national standards.

The ***Vienna Agreement*** (13) was reached between ISO and the CEN in 1992 (and revised in 1998). Put briefly, this agreement commits CEN TC 12 to adopt ISO TC 67 standards and vice versa:

The Vienna Agreement sets out two essential modes for collaborative development of standards: the mode under ISO lead and the mode under CEN lead, in which documents developed within one body are notified for the simultaneous approval by the other.

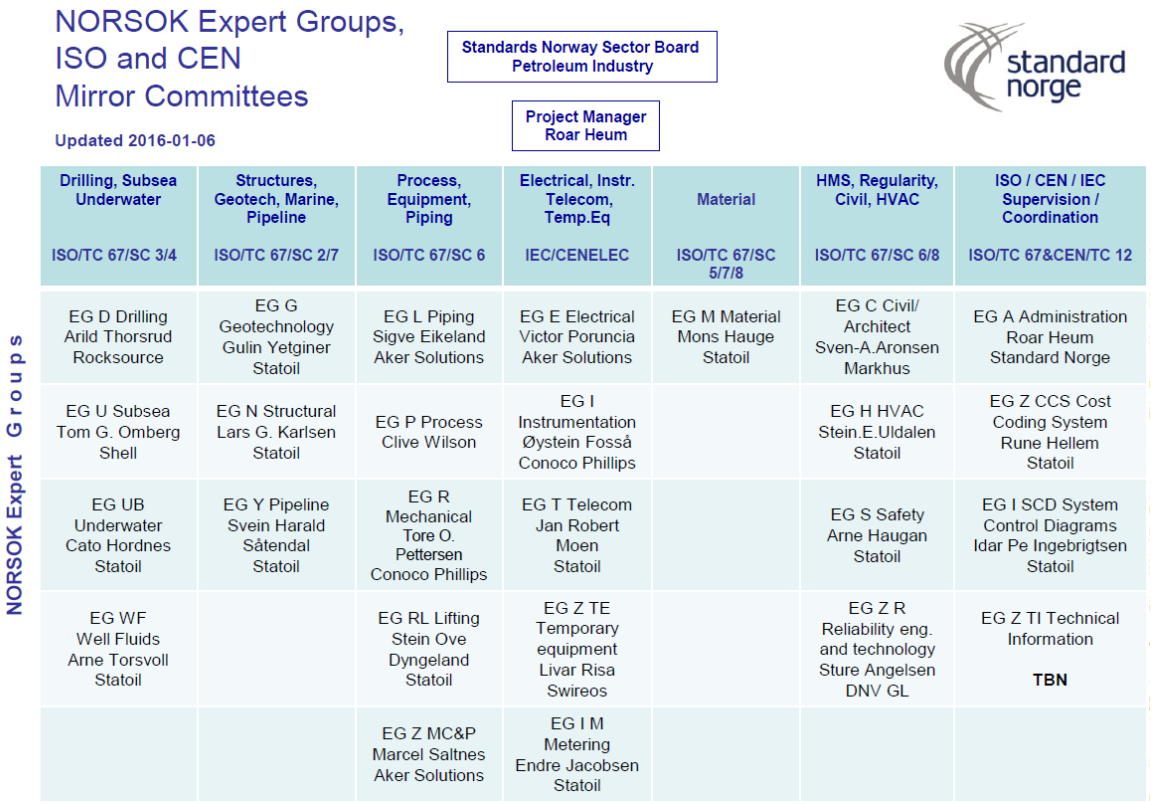
The benefits expected from the use of this agreement in accordance with the "implementation guidelines" include:

- increasing transparency of work ongoing in CEN to ISO members, and their possibility to influence the content of CEN standards;
- avoidance of duplication of work and structures, thus allowing expertise to be focused and used in an efficient way to the benefit of international standardization;
- increasing the speed of elaboration, availability and maintenance of standards through a need to establish consensus only once.

See more detailed information about the ***Vienna Agreement*** at *http://boss.cen.eu/ref/Vienna_Agreement.pdf*.

European standards could become more significant for the oil and gas industry, not least because the European Commission will probably take the initiative to create more harmonised standards in order to follow up directive 2013/30/EU on offshore safety.

The various ISO and CEN technical committees are supported by “mirror” committees in the member countries. Figure 6 shows how the various expert groups within the Norsok regime also function as mirror committees for ISO og the CEN.



NORSOK Expert Groups, ISO and CEN Mirror Committees

Updated 2016-01-06

Standards Norway Sector Board Petroleum Industry

Project Manager Roar Heum

standard norge

NORSOK Expert Groups

| Drilling, Subsea Underwater<br>ISO/TC 67/SC 3/4 | Structures, Geotech, Marine, Pipeline<br>ISO/TC 67/SC 2/7 | Process, Equipment, Piping<br>ISO/TC 67/SC 6 | Electrical, Instr. Telecom, Temp.Eq<br>IEC/CENELEC | Material<br>ISO/TC 67/SC 5/7/8 | HMS, Regularity, Civil, HVAC<br>ISO/TC 67/SC 6/8 | ISO / CEN / IEC Supervision / Coordination<br>ISO/TC 67&CEN/TC 12 |
|---|---|---|---|---|---|---|
| EG D Drilling<br>Arild Thorsrud<br>Rocksource | EG G<br>Geotechnology<br>Gulin Yetginer<br>Statoil | EG L Piping<br>Sigve Eikeland<br>Aker Solutions | EG E Electrical<br>Victor Poruncia<br>Aker Solutions | EG M Material<br>Mons Hauge<br>Statoil | EG C Civil/ Architect<br>Sven-A.Aronsen<br>Markhus | EG A Administration<br>Roar Heum<br>Standard Norge |
| EG U Subsea<br>Tom G. Omberg<br>Shell | EG N Structural<br>Lars G. Karlsen<br>Statoil | EG P Process<br>Clive Wilson | EG I Instrumentation<br>Øystein Fosså<br>Conoco Phillips | | EG H HVAC<br>Stein.E.Uldalen<br>Statoil | EG Z CCS Cost Coding System<br>Rune Hellem<br>Statoil |
| EG UB<br>Underwater<br>Cato Hordnes<br>Statoil | EG Y Pipeline<br>Svein Harald Såtendal<br>Statoil | EG R Mechanical<br>Tore O. Pettersen<br>Conoco Phillips | EG T Telecom<br>Jan Robert Moen<br>Statoil | | EG S Safety<br>Arne Haugan<br>Statoil | EG I SCD System Control Diagrams<br>Idar Pe Ingebrigtsen<br>Statoil |
| EG WF<br>Well Fluids<br>Arne Torsvoll<br>Statoil | | EG RL Lifting<br>Stein Ove Dyngeland<br>Statoil | EG Z TE Temporary equipment<br>Livar Risa<br>Swireos | | EG Z R<br>Reliability eng. and technology<br>Sture Angelsen<br>DNV GL | EG Z TI Technical Information<br>TBN |
| | | EG Z MC&P<br>Marcel Saltnes<br>Aker Solutions | EG I M<br>Metering<br>Endre Jacobsen<br>Statoil | | | |

Figure 6 – Norsok expert groups with corresponding ISO and CEN mirror committees at 1 January 2016. (Source: Standards Norway)

## 7.2 Comments on international standardisation in the oil and gas sector

In a global market, the industry will first and foremost work actively for the development and use of international standards. Clarifying the position for European and international standardisation in the oil and gas sector could be appropriate.

Two major challenges exist in international standardisation work:

- the breakdown in collaboration between ISO and the API
- trade embargoes against Iran and Russia.

Standardisation work in the petroleum sector is pursued at the European level in the CEN/Cenelec and internationally in ISO/IEC. Historically, the main activity has been at ISO level. The latter has collaborated with the American Petroleum Institute (API) over may years. In that context, it should be noted that the API is an organisation for developing industry rather than international standards. It has issued a number of industry standards in the petroleum sector. Over many years, ISO and the API issued common standards.

This collaboration has now broken down, in part over copyright-related issues. A further matter of concern is that the API has said it wants to strengthen international standardisation work under its auspices at the expense of the international work in ISO TC 67. American experts accordingly no longer represent a constructive driving force in the work of ISO and its technical committees.

International trade sanctions have long been imposed on Iran and Russia. Both countries belong to ISO, which is unable to exclude its members from standardisation work as long as they meet their membership obligations. A legal opinion secured by the central ISO secretariat concludes that standardisation work is not covered by trade embargoes. The international oil and gas industry takes the opposite view and is thereby reluctant to participate in ISO's standardisation work. A number of initiatives have been taken to comprehend the embargo legislation in relation to petroleum standardisation. However, this remains a very difficult issue. It concerns aspects related to both US and EU legislation.

Working with petroleum standardisation through ISO has therefore been very challenging for some time. To prevent standardisation work coming to a complete halt, the International Association of Oil and Gas Producers (IOGP) has become involved. It has pursued standardisation work on behalf of ISO, but without Iran and now also Russia being involved.

ISO standards are now being developed outside the organisation through the IOGP Standards Solution (earlier also called the IOGP Interim Solution). See figure 7. When a draft standard has been finalised and the technical discussions are completed, it is sent back by the IOGP to the ISO for the formal consultation process within the latter system. The process via the IOGP can take more time and has allegedly given rise at times to some uncertainty, but appears to be working as intended. A number of ISO standards have been issued in this way over the past couple of years.

Another aspect which could be worth mentioning is that participation by companies in international standardisation work can be difficult to finance during the present demanding times for the industry. The consequences of this thereby clash with the industry's expressed desire for an increased commitment to developing international petroleum standards.

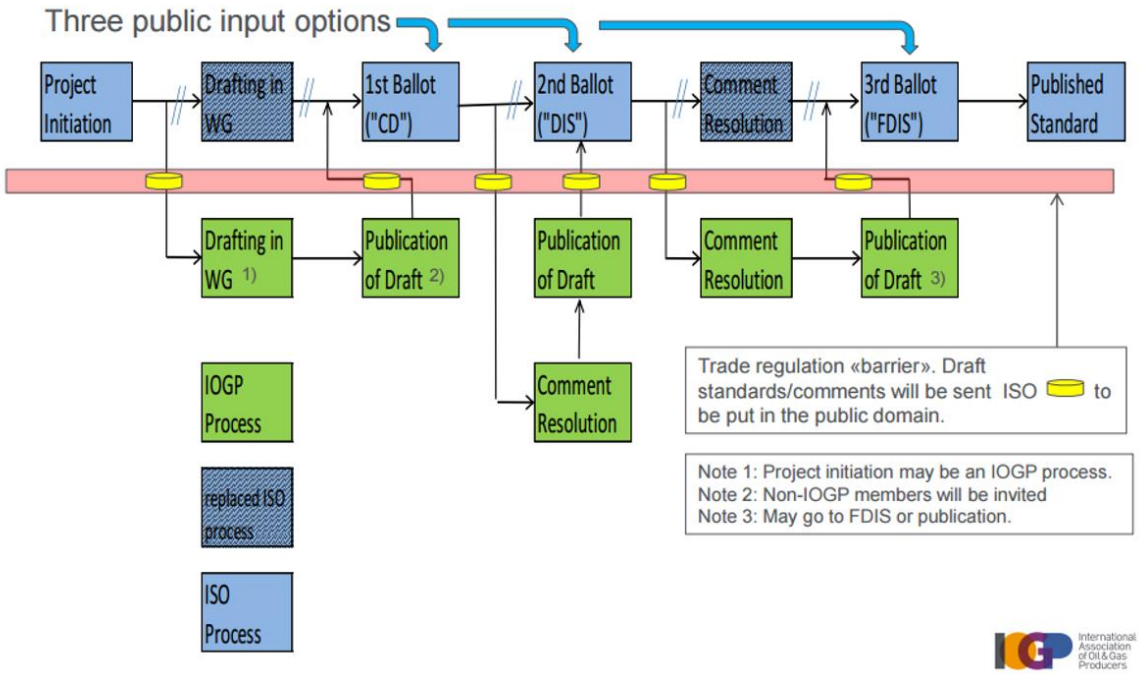



Figure 7 – Flow diagram of the IOGP Standards Solution. (Source: IOGP)

## 7.3 Goal of using international standards

The whole Norwegian petroleum industry, represented by Norwegian Oil and Gas, the Federation of Norwegian Industries and the Norwegian Shipowners' Association, wants the development of and access to high-quality standards. It is important that these standards contribute to good technical and cost-effective solutions in the petroleum sector. This will in turn influence how the industry can ensure good resource utilisation and the best possible petroleum management. That applies to industry, national and international standards.

- Examples of industry standards: Norsok, API, National Association of Corrosion Engineers (Nace), Energy Institute (EI).
- Examples of national standards: Norwegian Standard (NS), British Standard (BS).
- Examples of international standards: ISO, IEC, CEN, Cenelec, International Maritime Organisation (IMO).

The Norsok owners – Norwegian Oil and Gas, the Federation of Norwegian Industries and the Norwegian Shipowners Association – want to increase the use of international standards where relevant.

Both Norsok and international standards are referenced in Norway's HSE regulations. Roughly speaking, Norsok standards account for about 50 per cent of the references, while the other half refer to international standards from such bodies as ISO and the IEC, and to other recognised norms. See chapter 6.3.

The overarching concern for all standardisation work in the petroleum industry is to ensure good and verified solutions, reuse where appropriate, and predictability if possible. Where the suppliers industry is concerned, it will be important that the standards are adopted by many Norwegian companies, have good quality and allow work to be done in the same way for as many customers operating on the NCS as possible – giving more robust safety solutions and reduced risk. International standards, such as ISO, often represent a compromise between the needs of many stakeholders (many different nations). For its part, Norsok represents national standards enshrining 50 years of experience on the NCS.

Internationalising the Norsok standards has always been the goal, but it is important to avoid the development of international standards which would give more expensive solutions than Norsok's. In other words, if compromises mean that an international standard becomes very generalised and unspecific, this would have to be offset in many cases with more company-specific requirements – which would drive up costs in turn. Similarly, the industry is not served by internationalising standards if important safety principles are weakened and/or the technical solution or design is not as good as in the Norsok standard.

A balance accordingly needs to be struck between promoting international standards at any cost and developing and/or taking care of national industry standards like Norsok's. International standards will often be a compromise between the desires and needs of different member countries, and processes for issuing them are perceived to be more time-consuming than those relating to national industry standards.

## 7.4 Overview of relevant international standards

An overview of relevant international standards can be obtained from the following links.

***IOGP – Catalogue of international standards used in the petroleum and natural gas industries, (IOGP no 362 – February 2012)*** (14) http://www.iogp.org/pubs/362.pdf

***IOGP – Electrotechnical standards relevant for the oil and gas industry (IOGP no 530 – March 2015)*** (15), http://www.iogp.org/pubs/530.pdf

***IOGP – Standards and guidelines for well construction and well operations (IOGP no 485 – June 2016)*** (16), http://www.iogp.org/pubs/485.pdf

***IOGP – Material standards and committees for the international oil & gas industry (IOGP no 421 – June 2009)*** (17), http://www.iogp.org/pubs/421.pdf

***IOGP – Instrument & automation standards and committees for the international oil & gas industry (IOGP no 427 – July 2010)*** (18), http://www.iogp.org/pubs/427.pdf

***IOGP – Coatings standards and committees for the international oil & gas industry (IOGP no 428 – June 2010)*** (19), http://www.iogp.org/pubs/428.pdf

***IOGP – Regulators' use of standards (IOGP no 426 – March 2010)*** (20), http://www.iogp.org/pubs/426.pdf

***IOGP – Position paper on the development and use of international standards (IOGP no 381 - May 2007)*** (21), http://www.iogp.org/pubs/381.pdf

# 8 INTERNATIONAL APPLICATION OF NORSOK STANDARDS

A number of Norsok standards are utilised internationally as global or regional standards and/or as national standards in other countries.

## 8.1 Standards referenced in the regulations of various countries

In its report on ***Regulators' use of standards (no 426 – March 2010)*** (20), http://www.iogp.org/pubs/426.pdf , the IOGP has identified which standards are referenced in various national regulations. This overview presents a selection of references to Norsok standards.

UK
UK HSE Information References refer to:

- Norsok H-001 *Heating, ventilation and air conditioning and sanitary systems*
- Norsok N-001 *Integrity of offshore structures*
- Norsok N-002 *Collection of metocean data*
- Norsok N-003 *Actions and action effects*
- Norsok N-004 *Design of steel structures*
- Norsok N-005 *Condition monitoring of loadbearing structures*
- Norsok R-003 *Safe use of lifting equipment*
- Norsok S-001 *Technical safety*
- Norsok Z-001 *Documentation for operation*
- Norsok Z-013 *Risk and emergency preparedness assessment*

India
The Oil Industry Safety Directorate (OISD) refers to :

- Norsok S-003 *Environmental care*
- Norsok Z-013 *Risk and emergency preparedness assessment*

Venezuela, Ecuador, Argentina, Angola, Nigeria, Egypt, Cyprus, Romania, Poland, Israel, former Soviet states (excluding Russia) and Middle Eastern countries
The IOGP survey covers 13 countries outside Norway. Countries such as Venezuela, Ecuador, Argentina, Angola, Nigeria, Egypt, Cyprus, Romania, Poland, Israel, former Soviet states (excluding Russia) and Middle Eastern countries are not included. While Norsok standards are known to be in use by several of these countries, no overview is available of how far these standards are referenced in their regulations.

Australia, Canada, the USA, China and Russia
Another consideration is that Norsok standards could be reference by local regulations in large countries with a federal form of government. That applies to such states as Australia, Canada, the USA, China and Russia. Approaches have been received from Australia, for example, on proposing Norsok C-001 *Living quarters area* as an ISO standard since it is applied in Australia.

Greenland
The project secretariat has been informed (through conversation with a government representative) that Greenland intends to utilise the Norsok institute (all the Norsok standards) to supplement its offshore petroleum regulations.

## 8.2 International operator companies referencing Norsok globally

International operator companies reference Norsok globally in their management system. A number of these players are also known to require the use of certain Norsok standards for operations outside Norway. This includes, for example, Norsok D-010 *Well integrity in drilling and well operations* and the Norsok M series on materials. Norsok Z-013 *Risk and emergency preparedness assessment* is also used directly as a global management system in a number of companies.

In addition, Norsok is used as fabrication specifications in construction contracts abroad for facilities to be used on the NCS.

## 8.3 International suppliers use Norsok globally

As with the operator companies, certain international suppliers have incorporated Norsok standards in their global management systems. This applies, for example, to Norsok Z-015 *Temporary equipment* and Norsok D-010 *Well integrity in drilling and well operations*.

Large supplier companies have informed the secretariat that they use Norsok when specifying HSE requirements for sub-contractors in Poland, China and Korea. Examples include Norsok M-601, M-630, L-005 and M-001.

## 8.4 Comments on the global use of Norsok

The petroleum sector is a global industry. Using international standards can simplify projects and operation in the petroleum sector because the user is able to utilise the same standards regardless of where they are around the world.

An important question is then whether the most important consideration is that a common standard is used globally or that this common standard should be an ISO standard?

Global application of Norsok standards will have the same effect as using international standards. The advantage of this from a Norwegian perspective could be that 50 years of Norwegian offshore experience can be reflected in the standard without having to compromise with other less experienced countries. That will provide full control over development of the standard. Norwegian content and familiarity with the standard could also represent a competitive advantage in certain cases.

## 8.5 Use of Norsok outside the petroleum industry

The project secretariat has received confirmation that the prestigious European Organisation for Nuclear Research (Cern) uses Norsok standards, including Norsok L-001 *Piping and valves*.

Norsok is also used by suppliers in connection with offshore wind power projects. That applies, for example, to a number of Norsok standards in the M, N, S and C series.

# 9 NORSOK ANALYSIS PROJECT

The Norwegian Oil and Gas board adopted a new strategic position for the association on standardisation in September 2014. This was intended to establish long-term goals for and guidance on standardisation work in the Norwegian oil and gas industry and to provide a direction for reaching these objectives. Point 5 in the strategic position specifies that a review of all the Norsok standards will be undertaken. Similarly, the Federation of Norwegian Industries and the Norwegian Shipowners' Association had prepared standardisation strategies where one goal was to identify and prioritise which standards (including Norsok) they wanted to prioritise, develop and maintain on behalf of the Norsok owners. The Federation of Norwegian Industries wished to reduce the number and scope of company-specific requirements, and achieve greater reuse of solutions, concepts, methodology and requirements.

On that basis, the Norsok analysis project was established by the Norsok owners in the spring of 2015. Its goal was to define the Norsok owners' guidance for the owner portfolio – the Norsok standards. The project description is reproduced below.

## 9.1 Goal and deliveries

The goal of the Norsok analysis project was to encourage the development of and access to high-quality standards. These would contribute to technically good and cost-effective solutions in the petroleum industry. That would in turn influence the way this sector can ensure good resource utilisation and the best possible petroleum management.

In a global market, the industry will first and foremost work actively for the development and use of international standards. Furthermore, national industry standards, such as Norsok, will cover the identified gap between international standards and Norwegian requirements, but only where these are most appropriate. Development and maintenance of standards will thereby contribute to developing and maintaining the Norwegian industry's competitiveness nationally and internationally.

The Norsok analysis project was to contribute to reaching the following goals:

- ensure an acceptable level of safety
- increase the use of international standards
- reduce the use of special Norwegian requirements
- ensure that the standards which the industry determines to be Norsok standards contribute to cost-effective solutions
- help to improve the competitiveness of the NCS – in other words, make it more attractive for investment while encouraging exports by the Norwegian oil and gas supplies industry.

Examples from the industry which illustrate how the various Norsok standards contribute to reaching these objectives have been used where appropriate.

The Norsok analysis project took 79 Norsok standards, later reduced to 75, as its starting point for assessing all the standards in relation to the goals listed above.

An overview of all the standards is provided at the links below.

http://www.standard.no/en/sectors/energi-og-klima/petroleum/.

http://www.standard.no/Global/PDF/Petroleum/Norsok%20standards%20plansje%20A2%20-%20november%202015%20utskrift.pdf.

The project's final delivery was to assess the existing Norsok portfolio and place the standards in the following categories:

- which Norsok standards are recommended as international standards?
- which Norsok standards are recommended for continued use?
- which Norsok standards are recommended for withdrawal?

The project's goal was to reduce the number of Norsok standards. It has identified which standards the Norsok owners find appropriate for continued use.

The project's final delivery will be the Norsok owners' position in the sector board petroleum industry on the future direction they will recommend for the various Norsok standards.

## 9.2 Project criteria

The Norsok standards have been assessed in terms of:

- an acceptable level of safety
- costs (the standards should contribute to lower costs)
- competitiveness (the standards should encourage an industrialisation by standardising with regard to solutions, products and system which will ensure more secure execution at the right quality)
- internationalisation.

## 9.3 Methodological approach

The project was divided into sub-projects, each of which was treated as a group of Norsok standards. With some standards, the appropriate approach was to consider them individually. Each group assessed and analysed the individual Norsok standards in relation to possible corresponding international standards. Given the guidelines for this project, no standards can be duplicated – in other words, if an ISO or CEN standard covers the content in a Norsok standard, the latter is recommended for withdrawal.

Furthermore, each Norsok standard has been assessed in terms of the assumed consequences, costs and benefits for the petroleum sector related to its use, compared with other options. Each Norsok standard has been assessed to determine whether its use has helped or hindered the industry's competitiveness.

The alternatives each standard has been assessed against include:

- no standards available
- internal company requirements
- national requirements
- international requirements.

It was important to identify the largest number of examples from the industry which could illustrate the various effects of using a Norsok standard.

The assumed consequences, costs and benefits for each area may have been assessed differently by the various segments of the industry (operators, suppliers, consultants and so forth). Efforts have been made by the project to identify these differences/different requirements. Each Norsok standard has been assessed in terms of its contribution to an acceptable level of safety on the NCS. This should be documented through examples from the industry.

## 9.4 Organisation

The Norsok analysis project has been organised as shown in figure 8:

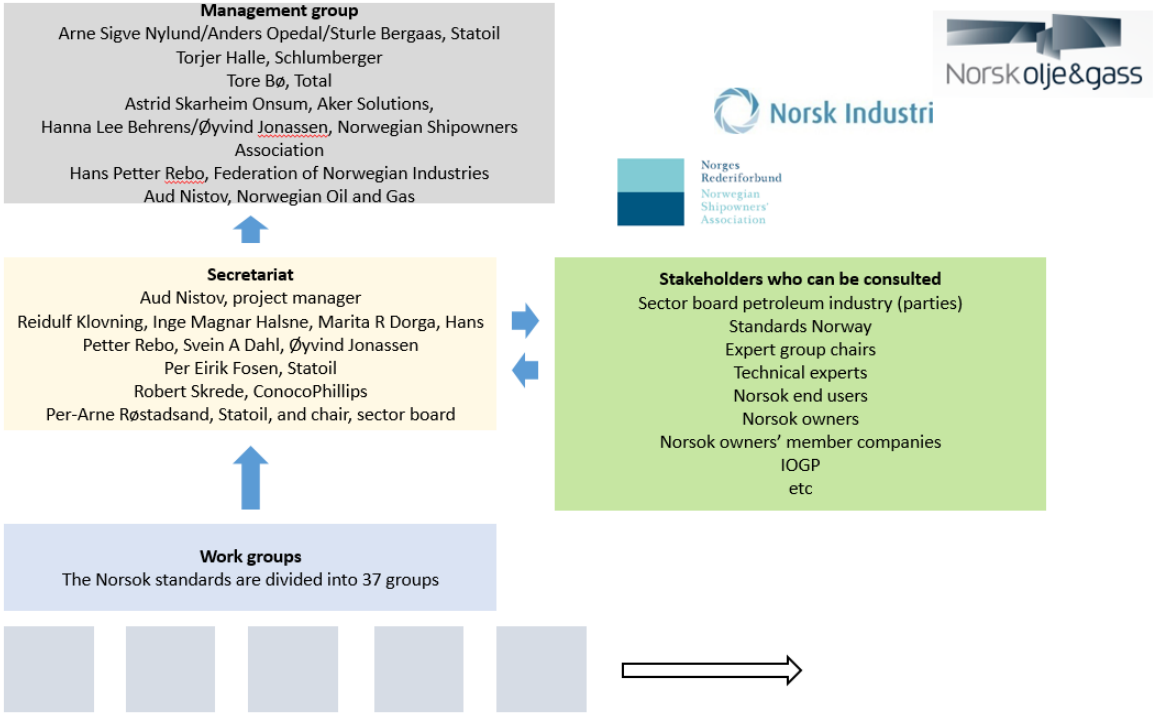



Figure 8 – Organisation of the Norsok analysis project.

### *9.4.1 The project management group*

The management group has comprised representatives of the Norsok owners:
- Arne Sigve Nylund, 02.09.2015–08.03.2016, Statoil, Norwegian Oil and Gas (operator)
- Anders Opedal, 08.03.2016–25.09.2016, Statoil, Norwegian Oil and Gas (operator)
- Sturle Bergaas, 25.09.2016–, Statoil, Norwegian Oil and Gas (operator)
- Tore Bø, Total, Norwegian Oil and Gas (operator)
- Torjer Halle, Schlumberger, Norwegian Oil and Gas (supplier)
- Astrid Skarheim Onsum, Aker Solutions, Federation of Norwegian Industries
- Hanna Lee Behrens, 02.09.2015–02.06.2016, Norwegian Shipowners Association
  Øyvind Jonassen, 02.06.2016–, Norwegian Shipowners Association
- Hans Petter Rebo, Federation of Norwegian Industries
- Aud Nistov, Norwegian Oil and Gas (project manager)

The management group will conduct an overall quality assurance of the project delivery, including:
- has the assignment been completed in accordance with the mandate?
- have the criteria for assessing the Norsok standard been complied with?
- has project progress been in accordance with the project plan?
- have project costs developed in line with the budget?

### *9.4.2 Project secretariat*

The project secretariat has comprised:
- Aud Nistov, Norwegian Oil and Gas – project manager
- Reidulf Klovning, Norwegian Oil and Gas
- Inge Magnar Halsne, Norwegian Oil and Gas
- Per-Arne Røstadsand, Statoil
- Per Eirik Fosen, Statoil
- Robert Skrede, ConocoPhillips
- Svein A. Dahl, IKM
- Hans Petter Rebo, Federation of Norwegian Industries
- Øyvind Jonassen, Norwegian Shipowners Association
- Marita R Dorga, Norwegian Oil and Gas.

The project secretariat has had the following duties:
- responsibility for project administration and progress
- follow-up of sub-projects
- making provision for consultation with relevant stakeholders/advisory groups
- making provision for meetings and preparing all matters for the management group.

The project manager reports to the project's management group.

### *9.4.3 Sub-projects*

Each sub-project has been organised as a work group. In addition, advisory groups have been established with stakeholders for each sub-project where appropriate. These have typically comprised technical specialists from the Norsok owners' member companies, various experts and other relevant stakeholders in the industry. Each sub-project reported to the project secretariat.

### *9.4.4 Advisers/experts*

Important industry stakeholders and representatives, external experts in various disciplines, representatives from the IOGP, Norsok owners' member companies, law firms with petroleum experience, key users of standards, Standards Norway, the sector board petroleum industry, the government and so forth represent important experience and expertise, and have been consulted where appropriate and relevant

### *9.4.5 Involvement of important stakeholders/involvement of parties*

Status reports for the Norsok analysis project have been submitted on a continuous basis to the sector board petroleum industry at Standards Norway during the project period.

## 9.5 Schedule

The project defined the following milestones:
- Norsok owners' common strategic position on petroleum standardisation, September 2014
- Norsok analysis project established, 2Q 2015
- management group for the project formally established, 3Q 2015.

The Norsok analysis project is due to be completed in late November 2016.

## 10 PROJECT DELIVERIES – NORSOK OWNERS' POSITION

This chapter presents the conclusions from the evaluation of the Norsok portfolio in the Norsok analysis project. These conclusions represent the Norsok owners' position with regard to the way they wish to manage their owner portfolio. This position will be submitted in Standards Norway's sector board petroleum industry.

Table 2 – Norsok owners' recommended position with regard to the Norsok standards.

| Standard | | Retained as Norsok | | Internationalisation | | | Withdrawn | Referenced in the regulations | Comments |
|---|---|---|---|---|---|---|---|---|---|
| | | | | Retained as Norsok for the time being | | | | | |
| No | Name | Revision should be a priority | | Prioritised for internationalisation | Should be internationalised | All or part of the standard should be integrated in international standards | | | |
| C-001 | Living quarters area | | | | X | | | x | |
| C-002 | Architectural components and equipment | | | | X | | | x | |
| C-004 | Helicopter deck on offshore installations | | X | | | | | x | |
| D-001 | Drilling facilities | | | | X | | | x | |
| D-002 | Well intervention equipment | | | | X | | | x | |
| D-007 | Well testing system | | | | X | | | x | |
| D-010 | Well integrity in drilling and well operations | | | X | | | | x | |
| E-001 | Electrical systems | | | | | | X | | Transferred to NEK as basis for IEC standard |
| H-003 | Heating, ventilation and air conditioning (HVAC) and sanitary systems | | | | | X | | x | |
| I-001 | Field Instrumentation | | X | | | | | | |
| I-002 | Safety and automation system (SAS) | | X | | | | | x | |
| I-005 | System control diagram | X | | | X | | | | Work towards the IEC initiated |
| I-106 | Fiscal metering systems for hydrocarbon liquid and gas | | | | X | | | x | |
| L-001 | Piping and valves | X | | | | | | x | |
| L-002 | Piping system layout, design and structural analysis | | X | | | | | x | |
| L-003 | Piping details | X | | | X | | | | |
| L-004 | Piping, fabrication, installation, flushing and testing | | X | | | | | x | |
| L-005 | Compact flanged connections | | | | | X | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| M-001 | Material selection | | | | | X | | x | |
| M-004 | Piping and equipment insulation | X | | | | | | x | |
| M-101 | Structural steel fabrication | | | | | X | | x | |
| M-102 | Structural aluminium fabrication | | X | | | | | | |
| M-120 | Material data sheets for structural steel | | | | | X | | | |
| M-121 | Aluminium structural material | | X | | | | | | |
| M-122 | Cast structural steel | | X | | | | | | |
| M-123 | Forged structural steel | | X | | | | | | |
| M-501 | Surface preparation and protective coating | | | | X | | | x | |
| M-503 | Cathodic protection | | | | | X | | x | |
| M-506 | $CO_2$ corrosion rate calculation model | | X | | | | | | |
| M-601 | Welding and inspection of piping | | | | | X | | x | |
| M-622 | Fabrication and installation of GRP piping systems | | | | | | X | | ISO 14692 |
| M-630 | Material data sheets and element data sheets for piping | | | | | X | | | |
| M-650 | Qualification of manufacturers of special materials | | | | | | X | | ISO 17782 |
| M-710 | Qualification of non-metallic materials and manufacturers – polymers | | | | | X | | | |
| N-001 | Integrity of offshore structures | | | | | X | | x | |
| N-002 | Collection of metocean data | | | | | | X | x | ISO 19901-1 |
| N-003 | Actions and action effects | | | | | X | | x | |
| N-004 | Design of steel structures | | | | | X | | x | |
| N-005 | Condition monitoring of loadbearing offshore structures | X | | | | | | x | |
| N-006 | Assessment of structural integrity for existing offshore loadbearing structures | | | | | X | | x | |
| P-002 | Process system design | | | | | X | | x | |
| R-001 | Mechanical equipment | X | | | | | | x | |
| R-002 | Lifting equipment | X | | | | | | x | |
| R-003 | Safe use of lifting equipment | X | | | | | | x | |
| R-005 | Safe use of lifting and transport equipment in onshore petroleum plants | X | | | | | | x | |
| S-001 | Technical safety | X | | | | X | | x | |
| S-002 | Working environment | X | | X | | | | x | |
| S-003 | Environmental care | X | | | X | | | | |

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| S-005 | Machinery – working environment analyses and documentation | | | | | | X | x | Appendix to Norsok S-002 |
| S-006 | HSE evaluation of contractors | | | | | | X | | IOGP 423 |
| S-011 | Safety equipment data sheets | | | | | | X | | Appendix to Norsok S-001 |
| S-012 | HSE in construction-related activities | | | | | | X | | IOGP 423 |
| T-001 | Telecom systems | | | | X | | | x | Should be merged with Norsok T-100 |
| T-003 | Telecommunication and IT systems for drilling units | | X | | | | | | |
| T-100 | Telecom subsystems | | | | X | | | x | Should be merged with Norsok T-001 |
| U-001 | Subsea production systems | X | | | | X | | x | |
| U-009 | Life extension for subsea systems | | | | | | X | | Replaced by a separate Norwegian Oil and Gas guideline (if necessary) |
| U-100 | Manned underwater operation | | X | | | | | x | |
| U-101 | Diving respiratory equipment | | | | X | | | x | |
| U-102 | Remotely operated vehicle (ROV) services | | X | | | | | | |
| U-103 | Petroleum-related manned underwater operations inshore | | X | | | | | x | |
| Y-002 | Life extension for transportation systems | | | | | | X | | Replaced by a separate Norwegian Oil and Gas guideline (if necessary) |
| Z-001 | Documentation for operation (DFO) | X | | X | | | | x | Should be a priority for internationalisation, but must initially be revitalised by Norsok to achieve this |
| Z-DP-002 | Coding system | | | | | | X | x | Standard not in use |
| Z-CR-002 | Component identification system | | | | | | X | | ISO 15926 |
| Z-003 | Technical information flow requirements | X | | | | X | | x | As Z-001 |
| Z-004 | CAD symbol libraries | X | | | | | | | |
| Z-005 | 2D CAD drawing standard | X | | | | | | | |
| Z-006 | Preservation | | | | X | | | x | |
| Z-007 | Mechanical completion and commissioning | | | | X | | | x | |
| Z-008 | Risk-based maintenance and consequence classification | X | | | X | | | x | |
| Z-013 | Risk and emergency preparedness assessment | X | | | | X | | x | |
| Z-014 | Standard cost coding system (SCCS). | | | | | | X | | ISO 19008 |
| Z-015 | Temporary equipment | X | | | X | | | x | |
| Z-018 | Supplier's documentation of equipment | X | | X | | | | | As Z-001 |

# 11 RECOMMENDATIONS

The purpose of the Norsok analysis project has been to prepare the joint position of the Norsok owners on the Norsok portfolio – in other words, to develop a position on each Norsok standard with regard to future priorities and commitment of resources. Decisions related to the individual Norsok standard, including proposals for internationalisation, go-aheads for revision work, approval of revision, withdrawal and so forth, will continue to be taken by the sector board petroleum industry.

## 11.1 Norsok owners' position – summary

The Norsok analysis project has produced a number of recommendations related to the existing portfolio of 75 Norsok standards. Recommendations by the Norsok owners concerning the existing 75 Norsok standards are summarised in figure 9.

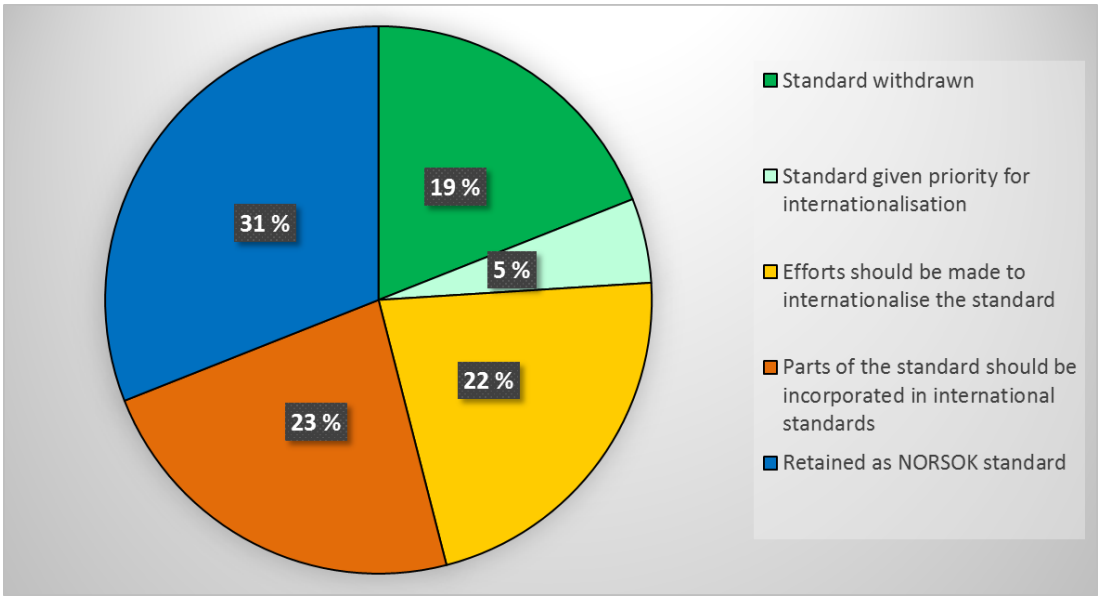



Figure 9 – Recommendations by the Norsok owners on the existing 75 Norsok standards.

The Norsok owners make the following recommendations.

- 19 per cent of the Norsok standards to be withdrawn.
  This recommendation recognises that six of these standards are already proposed as international standards, and the content of the Norsok standards will accordingly be found in the relevant ISO and IEC standards. Inclusion in other existing Norsok standards is proposed for two of the standards. Two are proposed for replacement by IOGP guidelines. Two are proposed for transfer to Norwegian Oil and Gas guidelines. Withdrawal is proposed for one standard because it is not in use. It is also proposed to merge two standards into a single Norsok standard. Overall, this will remove a total of 14 standards from the Norsok portfolio.

- 5 per cent of the Norsok standards are given priority for internationalisation.

- 22 per cent of Norsok standards should ultimately be proposed as international standards.

- 23 per cent of the Norsok standards should ultimately be proposed as improvements to existing international standards.

- 31 per cent of the Norsok standards should be retained as Norsok standards.

## 11.2 Withdrawal of Norsok standards

The Norsok analysis project has concluded that a total of 13 Norsok standards should be recommended for withdrawal.

- E-001 *Electrical systems* – transferred to the Norwegian Electrotechnical Committee (NEK) for follow-up with the International Electrotechnical Commission (IEC).
- M-622 *Fabrication and installation of GRP piping systems* – transferred to ISO 14692.
- M-650 *Qualification of manufactures of special materials* – transferred to ISO 17782.
- N-002 *Collection of metocean data* – transferred to ISO 19901-1.
- S-005 *Machinery – working environment analyses and documentation* – transferred to Norsok S-002.
- S-006 *HSE evaluation of contractors* – replaced by IOGP 423.
- S-011 *Safety equipment data sheets* – transferred to Norsok S-001.
- S-012 *Health, safety and the environment (HSE) in construction-related activities* – replaced by IOGP 423.
- U-009 *Life extension for subsea systems* – content transferred to Norwegian Oil and Gas guideline 122.
- Y-002 *Life extension for transportation systems* – content transferred to Norwegian Oil and Gas guideline 122.
- Z-014 *Standard cost coding system (SCCS)* – transferred to ISO 19008.
- Z-CR-002 *Component identification system* – transferred to ISO 15926.
- Z-DP-002 *Coding system* – withdrawn because it is no longer in use.

In addition, merging Norsok T-001 *Telecom systems* and T-100 *Telecom subsystems* to form a single Norsok standard is recommended.

This means that the Norsok analysis project recommends reducing the Norsok portfolio by a total of 14 standards. However, the content of these standards be continued through other standards. This will free up administrative resources which can be redirected to other standards.

## 11.3 Priority for "internationalisation"

The Norsok analysis project has identified four Norsok standards which could be appropriate to prioritise for proposing as international standards. Their common denominator is that no existing international standards fully cover the corresponding discipline. In addition, the Norsok analysis project has become aware that these standards are already in widespread use outside Norway.

This applies to the following standards.

D-010 *Well integrity in drilling and well operations*
Z-001 *Documentation for operations (DFO)*
Z-013 *Risk and emergency preparedness assessment*
Z-018 *Suppliers' documentation of equipment*

International standardisation work is relatively demanding in terms of resources committed. The project has therefore confined itself to recommending four standards for a priority commitment on internationalisation.

### *11.3.1 Grounds for prioritisation – Norsok D-010*

Norsok D-010 is widely used outside Norway. In this context, it can be mentioned that a number of oil service companies and operators use the standard as their "global standard" for well design as well as for planning and executing well activities and operations.

A number of international standards cover part of the content in Norsok D-010, but assembling all the requirements for well integrity in a single standard is considered cost-effective compared with having to deal with about 50 different international standards.

### *11.3.2 Grounds for prioritisation – Norsok Z-001*

Norsok Z-001 is in use outside Norway. The UK can be mentioned here.

Very few international standards relate to the discipline covered by Z-001. A good Norsok Z-001 will accordingly have great potential benefit far beyond Norway's borders and should be given priority for proposal as a new international standard. However, this assumes that the standard is revised before efforts are made to internationalise it.

Furthermore, it is important to point out that a detailed mandate giving clear directions for the work must be prepared before beginning a revision of Norsok Z-001. For this considerable job to begin, the operator companies with head offices in Norway must commit to leading and providing resources for the work.

### *11.3.3 Grounds for prioritisation – Norsok Z-013*

Norsok Z-013 is in use outside Norway. The UK, India and a number of other countries can be mentioned here. It is also used as a global standard by a number of companies.

Several international standards exist in the discipline covered by Z-013. However, these do not deal with the whole area addressed by Norsok Z-013. This standard should be related more closely to or incorporated in ISO 15544 and ISO 17776.

The standard should be revised in order to adapt it to international standards and new regulations before being proposed (wholly or in part) as an international standard.

### *11.3.4 Grounds for prioritisation – Norsok Z-018*

Norsok Z-018 is in use outside Norway.

Very few international standards are available in the discipline covered by Z-018. A good Norsok Z-018 will accordingly have great potential benefit far beyond Norway's borders and should be given priority for proposal as a new international standard. However, this assumes that the standard is revised before efforts are made to internationalise it.

Furthermore, it is important to point out that a detailed mandate giving clear directions for the work must be prepared before beginning a revision of Norsok Z-018. For this extensive job to begin, the operator companies with head offices in Norway must commit to leading and providing resources for the work.

This means that the Norsok analysis project proposes (within a relatively short time frame) reducing the Norsok portfolio by a total of 18 standards. This corresponds to about a quarter of the portfolio which formed the starting point for the project.

## 11.4 Norsok owners' recommendations concerning "internationalisation"

It is recommended that the remaining portfolio of 57 Norsok standards be retained, but that active efforts should be made in the longer term to propose a number of Norsok standards as international standards. However, this would depend on ensuring that the international standard does not become a compromise which weakens requirements for acceptable safety and/or would need to be supplemented by company-specific requirements. The goal of Norwegian petroleum standardisation must be to limit the need for company-specific requirements.

In addition, it will be relevant to propose parts of a number of Norsok standards as improvements to existing international standards. Priorities for such work are governed by when the relevant international standard comes up for revision.

As mentioned above, the industry will first and foremost work actively for the development and use of international standards. Two points of entry to international standards (ISO/CEN) are available for the Norsok standards.

- The Norwegian members of ISO and CEN work groups put forward relevant sections of the Norsok standards' content as proposals to current assignments.

- Via Standards Norway (as the country's member of ISO), Norway can put forward the Norsok standards as drafts for new ISO or CEN standards by proposing them as new assignments. Such an initiative is conditional on Norway securing the necessary support from at least four other member states. Norway should be willing to provide the project leader when such assignments are proposed.

The purpose of these measures is to help develop international standards which are appropriate for the NCS, so that the relevant Norsok standard can be reduced or withdrawn completely when the ISO or CEN standards become available. Special Norwegian specifications can thereby be further reduced and international standards used instead.

Evaluations made on behalf of the Norsok analysis project indicate that many of the Norsok standards could be suitable as the basis for an international standard.

The challenge for the project secretariat has been to identify the best examples or opportunities for developing international standards. Selecting which standards should be given priority in the international arena has also been demanding.

Norsok Z-014 *Standard cost coding system* is a recent example of a Norsok standard being used as the basis for establishing a completely new ISO standard – ISO 19008 *Standard cost coding system for oil and gas production and processing facilities*. The proposal for a new ISO standard in this area was submitted by Norway.

Table 3 lists which Norsok standards should be the basis for international standards. Furthermore, it provides an overview of which Norsok standards should be assessed for full or partial inclusion in an existing international standard. The table also shows which standards are not suitable for internationalisation and should therefore be retained as Norsok standards.

Table 3 groups all the Norsok standards (except those recommended for withdrawal) in the following four categories.

**A:** Norsok standards which should be given priority as the basis for international standardisation.

**B:** Norsok standards which should be used as the basis for international standardisation. These relate to areas which are by large not covered by any international standard.

**C:** Norsok standards where all or part of their content should be incorporated as improvements to one or more existing international standards. Prioritisation of the work is governed by when the international standard comes up for revision. The Norsok standard must be revised or withdrawn after part of its content has been included in one or more international standards.

**D:** Standards which should basically be retained as Norsok standards.

Table 3 – Summary of the Norsok portfolio and which Norsok standards which should form the basis (wholly or in part) for international standards.

| A | B | C | D |
|---|---|---|---|
| D-010 | C-001 | H-003[4] | C-004 |
| | C-002 | | |
| Z-001[2] | | L-005 | I-001 |
| Z-013[2] | D-001 | | I-002 |
| Z-018[2] | D-002[3] | N-001[5] | |
| | D-007[3] | N-003[6] | L-001 |
| | | N-004[7] | L-002 |
| | I-005 | N-006 | L-004 |
| | I-106[3] | | |
| | | M-001 | M-004 (R-004) |
| | L-003 | M-101[8] | M-102 |
| | | M-120[8] | M-121 |
| | M-501 | M-503 | M-122 |
| | | M-601 | M-123 |
| | S-002[1] | M-630[9] | M-506 |
| | S-003 | M-710[10] | |
| | | | N-005 |
| | T-001[3] | P-002 | |
| | T-100[3] | | R-001 |
| | | S-001 | R-002 |
| | U-101 | | R-003 |
| | | U-001 | R-005 |
| | Z-006 | | |
| | Z-007 | Z-003 | U-100 |
| | Z-008 | Z-013 | U-102 |
| | Z-015 | | U-103 |
| | | | T-003 |
| | | | Z-004 |
| | | | Z-005 |

Notes to table 3:

[1] The current revision of Norsok S-002 *Working environment* should be completed before the standard is put forward as the basis for an international standard. In addition, ISO 35101 *Arctic operations — Working environment* and ISO 45001 *Occupational Health and Safety Management System* should be completed and published as new standards.

[2] The standard should be updated before being put forward as the basis for an international standard.

[3] No international standard covers the whole scope of this Norsok standard. The interface with parts of this standard's coverage must be clarified.

[4] The scope of H-003 should be evaluated in relation to the current revision of ISO 15138 *Offshore production installations - heating, ventilation and air-conditioning*. The decision to revise ISO 15138 was taken because the previous version was issued in 2007.

[5] N-001 *Integrity of offshore structures*. Goal: only remaining Norsok N standard, or a Norwegian annex to ISO 19900 *General requirements for offshore structures*.

[6] N-003 *Actions and action effects*. Should be simplified and harmonised as much as possible with ISO-19901-1 *Specific requirements for offshore structures - Part 1: Metocean design and operating considerations*. The goal should be that N-003 can be phased out in the same way as the Norsok *Metocean* (N-002) and *Marine soil investigations* (G-001) standards.

[7] N-004 *Design of steel structures*. Should be the basis for further work on improving ISO 19902 *Fixed steel offshore structures* and 19901-3 *Specific requirements for offshore structures - Part 3 Topsides structure*.

[8] M-101 should be revised after ISO 19902 *Fixed steel offshore structures* has been revised. Norway has delivered important proposals for 19902. M-120 *Material data sheets for structural stee*l should be simplified and harmonised with the current revision of ISO 19902.

[9] When ISO 17782 has been completed, M-630 *Material data sheets and element data sheets for piping* should refer to it with regard to testing and acceptance criteria.

[10] Efforts should be made to include M-710 wholly or in part in the next revision of ISO 23936-2 *Non-metallic materials in contact with media related to oil and gas production - Part 2: Elastomers*.

Norway has much to contribute to international standardisation work. The country is established as a substantial supplier of oil and gas in the global market. It is therefore in Norway's interests that international standards are adapted as far as possible to its requirements. This will mean that national requirements can be reduced or preferably eliminated, with a positive effect on development and operating costs.

Norway has been involved from the start in the work of ISO technical committee 67 – Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries (ISO TC 67) and other important committees in international petroleum standardisation. This commitment has largely been undertaken by interested representatives from various companies.

It is important, and a precondition, that this work is given greater priority at management level in the companies, and that the necessary resources and personnel are made available for the many activities embraced by international petroleum standardisation.

Norway should furthermore seek to lead key international standardisation activities which are significant for the Norwegian petroleum industry.

## 11.5 The Norsok owners' priority recommendations

The Norsok analysis project recommends a priority commitment in the following areas.

- Z standards on technical information (Z-001, Z-003, Z-004, Z-005 and Z-018).
- S-002 covering working environment requirements.
- R standards on lifting equipment (R-002, R-003 and R-005).
- L standards dealing with piping (L-001 and L-CR-003).
- Z-008 on risk based maintenance and consequence classification.
- Z-013 on risk and emergency preparedness assessment.
- S-003 on environmental care.
- U-001 on subsea production systems.
- Z-015 on temporary equipment.
- I-005 on system control diagram.
- S-001 on technical safety.
- N-005 on condition monitoring of loadbearing structures.
- M-004 on piping and equipment insulation.
- D-010 on well integrity in drilling and well operations.

It can be noted that revision work has already been initiated/is under way for several of these standards.

### *11.5.1 Grounds for prioritisation: Z standards on technical information*

The Norsok analysis project has identified a need to revise the Norsok standards covering those parts of the Z series dealing with technical information (documentation requirements).

That applies to the following Norsok standards:
Norsok Z-001 *Documentation for operation (DFO)*
Norsok Z-003 *Technical information flow requirements*
Norsok Z-004 *CAD symbol libraries*
Norsok Z-005 *2D-CAD drawing standard*
Norsok Z-018 *Supplier's documentation of equipment*

This work should be given the highest priority. Some of these standards have not been updated for almost 20 years. They are therefore thoroughly out of date. A precondition for initiating the considerable work involved is that the operator companies with head offices in Norway commit to allocating resources to lead and drive this revision project

A clear mandate should be prepared for the revision work which clarifies its direction. This mandate must describe the work to be done, how it should be carried out, the resources required and how the work should be initiated. However, a great deal needs to be clarified before this work can begin. That includes a decision on whether to start the work from scratch or to take the existing standards as the starting point. A further precondition is that guidance can be adopted at an early stage for a common life-cycle information (LCI) strategy.

The Norsok analysis project has clarified that Statoil will take a leading role in this work together with ConocoPhillips and Aker Solutions.

The Z standards are regarded by the Norsok analysis project as the most important area for achieving further cost reductions and enhanced efficiency in the industry.

This assessment is supported by PSA's project to clarify the scope of documentation in the Norwegian petroleum industry [***Dokumentasjonsprosjektet – Kartlegging av dokumentasjonsomfanget i petroleumsnæringen*** (23) – in Norwegian only].

The PSA project proposes the establishment of a new standard for handling LCI requirements during the various phases of a field development and for later stages in the life cycle of a facility. The Norsok analysis project is reserved about establishing such new standards. The PSA proposal should rather be included in the work programmes for further development of the existing Norsok Z standards. The Norsok analysis project recommends that the standards should basically cover technical requirements and pay less attention to management and organisation in the individual companies. Digitalisation to make updated information accessible must be the goal for these standards hence for this work.

When the revised Z-001 and Z-018 are available, they should be given the highest priority as the basis for international standards. This means the project proposes that Z-001 and Z-018 be put forward as new international standards. No international standards exist in this area.

### *11.5.2 Grounds for prioritisation: S standard on working environment requirements*

The Norsok analysis project has identified a need to give high priority to a revision of Norsok S-002 *Working environment*. This standard is claimed to be a cost-driver for the Norwegian petroleum industry. The project has found that it has largely replaced internal company requirements in the area. A goal for the revision should be that the standard is formulated in a way which makes internal company requirements unnecessary. Furthermore, it has been documented that Norsok S-002 can be a cost-driver for facilities which operate across continental shelf boundaries. Norsok S-002 should be put forward as the basis for an international standard. No international standards exist for the whole scope of this standard.

The following recommendations are made for revising Norsok S-002 *Working environment*.

- Norsok S-002 in its revised form should be proposed for publication as an ISO standard corresponding to ISO 35101.
- Norsok S-002 should incorporate the essence of Norsok S-005's content.
- Norsok S-002 should be a design standard which could also be suitable for operations.
- The target group should be the project and not the working environment discipline (including acoustics and human factors). The standard should be applicable to all relevant project disciplines.
- For the moment, the standard should be simplified in relation to the consultation draft for a new S-002. Big changes to the design of the standard would mean the industry needs time to adapt and would thereby involve a certain cost.
- The standard should be formulated in such a way that internal company design requirements for the working environment in the Norwegian petroleum sector are unnecessary.
- The standard should be formulated so that it can be used for both large and small projects, whether newbuild, modification or removal. Its application to vessels and unmanned facilities (standard of comfort) should also be described where relevant.
- The standard should build on experience-based design and make little demand for separate analysis. Specific requirements should largely be given, and little analysis should be required in the project.
- The standard should be formulated with a level of precision which reduces the need for clarifications in the supplier chain to a minimum.
- The standard should be formulated in a way which is neutral in relation to regulations – in other words, all references to Norwegian regulations should be removed.
- Where the standard is not supported by good industry guidance or manuals, these should be developed rather than including extra guidance text in the standard.
- The standard should have a separate chapter on machines which incorporates the essence of Norsok S-005 and specifies the use of various machinery standards.

### *11.5.3 Grounds for prioritisation: R standards on lifting equipment*

The Norsok analysis project has identified a need to give high priority to revising the following R standards:
Norsok R-002 *Lifting equipment*
Norsok R-003 *Safe use of lifting equipment*
Norsok R-005 *Safe use of lifting and transport equipment in onshore petroleum plants*

The background for recommending that Norsok R-002 should be given priority for revision is that the standard specifies special Norwegian requirements in certain areas which impose substantial costs. These special requirements are particularly onerous for mobile units which require an acknowledgement of compliance (AoC) for operating on the NCS. Where such units are concerned, the provisions in Norsok R-002 require the conversion of cranes and other lifting equipment, as well as rescue and evacuation equipment. International suppliers of lifting equipment claim that products delivered pursuant to Norsok R-002 have a mark-up of 10-20 per cent. However, it should be noted that Norsok R-002 has helped to raise the level of safety on the NCS and that the standard provides a good description of how risk analyses should document an acceptable level of safety for lifting equipment. Revision work should give priority to reducing cost-driving requirements where the cost is disproportionate to the safety gain. In the longer term, all or part of the standard may be incorporated as improvements to an international standard.

The background for recommending that Norsok R-003 should be given priority for revision is that the standard has contributed to a substantial raising of the safety level for lifting operations in the petroleum industry. Norsok R-003 contains a main section (the actual standard) and appendices. The actual standard specifies operational and administrative requirements, while a number of competence requirements and training curricula are collected in appendix B. This appendix is referenced in section 21 of the activities regulations on competence. Extensive prescriptive competence requirements (with 22 associated training curricula) are therefore contained in Norsok R-003, and have become normative for the industry through the regulatory reference. This has a cost-driving effect without it being possible to document a proportionate safety gain from these extensive competence requirements. The Norsok analysis project recommends that Norsok standards should not contain requirements for competence and training. See chapter 11.6. Revision work should give priority to removing those competence requirements whose safety benefit is difficult to document. In addition, the standard contains a number of technical references. These should be removed from the standard. This standard is not suitable as an international standard and should be retained.

The background for recommending that Norsok R-005 should be given priority for revision is that a need exists for such a revision, where attention should be concentrated on enhancing efficiency and reducing costs. In addition, a need to simplify the standard and remove unnecessary details has been identified.

### *11.5.4 Grounds for prioritisation: L standards on piping*

The Norsok analysis project has identified a need to give priority to a revision of the following L standards:
Norsok L-001 *Piping and valves*
Norsok L-CR-003 (L-003) *Piping details*

The background for recommending that the L series should be given priority for revision is that all these standards are considered to contribute to an acceptable level of safety and to provide good technical and cost-effective solutions in the petroleum sector. However, a substantial potential has been identified for further cost savings with the L standards by reducing the number of choices (variant restriction) in some of these.

Norsok L-001 is recommended for retention as a Norsok standard. Norsok L-003 should be put forward as the basis for an international standard.

### *11.5.5 Grounds for prioritisation: the Z standard on risk-based maintenance and consequence classification*

The Norsok analysis project has identified a need to give priority to revising Norsok Z-008 *Risk-based maintenance and consequence classification*.

The background for recommending that Norsok Z-008 should be given priority for revision is that the project's evaluation has identified that the standard is imprecise in certain areas. It describes risk-based maintenance. However, the HSE regulations refer to standards other than Z-008 for maintenance programmes. The project has identified that a misunderstanding exists about this in the industry, and that the impression of duplicated regulation could arise in this area. To avoid giving the impression that the regulations refer to Z-008, it is recommended that revision work deletes chapter 8 on the maintenance programme as a normative requirement in the standard. Norsok Z-008 should be put forward as the basis for an international standard.

### *11.5.6 Grounds for prioritisation: the Z standard on risk and emergency preparedness assessment*

The Norsok analysis project has identified a need to give priority to revising Norsok Z-013 *Risk and emergency preparedness assessment*.

The background for recommending that Norsok Z-013 should be given priority for revision is that the standard should be adapted to recently revised international standards as well as new regulations (including section 11 to the framework regulations with guidelines) which incorporate a new definition of risk. While these conditions must be reflected in Z-013, it is important that this standard clarifies which practice it wishes to support. Several international standards exist in the discipline covered by Z-013. However, these do not deal with the whole area addressed by Norsok Z-013. This standard should be related more closely to or incorporated in ISO 15544 and ISO 17776. The standard should be revised in order to adapt it to international standards and new regulations before being proposed (wholly or in part) as an international standard. Norsok Z-013 should be given the highest priority as the basis for improvements to existing international standards.

### *11.5.7 Grounds for prioritisation: the S standard on environmental care*

The Norsok analysis project has identified a need to give priority to revising Norsok S-003 *Environmental care*.

The background for recommending that Norsok S-003 should be given priority for revision is that the standard was last modified in 2005 – in other words, more than 11 years ago. New/amended regulatory requirements have emerged during this period, and an update is accordingly required. Norsok S-003 should be put forward as the basis for an international standard.

### *11.5.8 Grounds for prioritisation: the U standard on subsea production systems*

The Norsok analysis project has identified a need to give priority to revising Norsok U-001 *Subsea production systems*.

Norsok U-001 was recently revised to version 4 (issued October 2015). However it is proposed that the standard needs to be revised, and it is desirable that this aims to divide the existing U-001 into a main document with appendices which can cover relevant references in either ISO or API. That will simplify future maintenance of references and updating of the standard. The standard is regarded as very important for the industry, and this discipline is particularly exposed to the conflict between ISO and the API. Work on this discipline should accordingly be given priority by the Norwegian petroleum industry. In the longer term, Norsok U-001 should be proposed as improvements to existing international standards.

### *11.5.9 Grounds for prioritisation: the Z standard on temporary equipment*

The Norsok analysis project has identified a need to give priority to revising Norsok Z-015 *Temporary equipment*.

The background for establishing Norsok Z-015 was that different oil companies had their own and variant specifications for temporary equipment. That made it difficult and costly for suppliers to meet the requirements in these documents. The introduction of Z-015 provided a quality and efficiency boost which laid the basis for cost reductions. However, it is claimed that the detailed requirements in Z-015 go a little too far and result in some cases in unnecessary extra costs for the industry, in that certain requirements complicate direct transfer of international temporary equipment to Norwegian facilities. A revision to address these aspects is accordingly required. Z-015 should be put forward as the basis for an international standard.

### *11.5.10 Grounds for prioritisation: I-005 on system control diagram*

The Norsok analysis project has identified a need to give priority to revising Norsok I-005 *System control diagram*. I-005 helps to standardise and visualise programming functions and input to make them more easily accessible to disciplines other than automation. I-005 should be put forward as the basis for an international standard, and work on an internationalisation has begun in IEC TC 65. However, a requirement has been identified for corrections and updating in the standard, and these should be completed so that the IEC has the best basis for establishing an IEC standard on this subject.

### *11.5.11 Grounds for prioritisation: S-001 on technical safety*

The Norsok analysis project has identified a need to give priority to revising Norsok S-001 *Technical safety*.

Norsok S-001 details performance-based regulatory requirements so that these are complied with to provide a good design in safety terms. The requirements in S-001 represent a level of robustness assumed in the Norwegian regulations. It amplifies the performance-based requirements and principles in ISO 13702. At the moment, the requirements in ISO 13702 are insufficiently specific to achieve the Norwegian level of safety. Replacing S-001 with ISO 13702 would be a considerable process. However, S-001 should be proposed in the long run as improvements to existing international standards. However, it is assumed that the content has been updated before such a process begins.

*11.5.12 Grounds for prioritisation: N-005 on condition monitoring of loadbearing structures*

The Norsok analysis project has identified a need to give priority to revising Norsok N-005 *Condition monitoring of loadbearing structures*. This standard is currently undergoing revision, and that work should be completed.

*11.5.13 Grounds for prioritisation: M-004 on piping and equipment insulation*

The Norsok analysis project has identified a need to give priority to revising Norsok M-004 *Piping and equipment insulation* (previously R-004). This standard has been transferred from expert group R to expert group M. Technology development in this area has been substantial, and the standard should be revised.

*11.5.14 Grounds for prioritisation: the D standard on well integrity in drilling and well operations*

The Norsok analysis project recommends that Norsok D-010 *Well integrity in drilling and well operations* should be prioritised for revision. Norsok D-010 is a very important standard for both operators and suppliers in connection with well design and for planning and executing well activities and operations. It is accordingly a recognised standard both nationally and internationally. It has been established as a global standard by a number of companies, and is referenced by the authorities in other countries. Some 50 different international standards cover minor parts of Norsok D-010's area of application. The project recommends that Norsok D-010 is given the highest priority as a proposal for a new international standard.

## 11.6 General recommendations for further work on Norsok standards

*11.6.1 Competence and training requirements*

A small number of Norsok standards contain requirements on competence and training. Whether Norsok standards should incorporate such requirements has been questioned as a matter of principle. Since some of the standards which specify competence and training requirements are also referenced in the HSE regulations, these requirements are interpreted as virtually binding in normative terms.

The project recommends that competence and training requirements in Norsok standards should be:

- entrenched as a requirement with the Norsok owners
- formulated as performance-based requirements.

Furthermore, the Norsok analysis project recommends that Norsok standards should not contain:

- requirements specified in a corresponding form in an international standard
- certification requirements or requirements for certification of course providers
- training requirements in the form of courses or course implementation outside the company.

Nor should competence requirements be repeated in a Norsok standard if identically worded provisions are incorporated in Norwegian regulations. Efforts should rather be made to make such requirements directly applicable to offshore petroleum operations in a dialogue with the authorities.

### *11.6.2 Requirements for operational conditions, management and contractual relations*

Certain Norsok standards contain requirements for operations-related conditions. Some stakeholders argue that the Norsok standards should be confined to design, systems, structures and so forth, while provisions which describe operational procedures and/or management in a company should be avoided.

On the other hand, the Norsok standards build on 50 years of experience from Norwegian petroleum operations, including experience from incidents which have led to the revision of certain Norsok standards and thereby produced improvements in the form of more robust safety. This also applies to operational conditions.

Similar discussions have occurred in relation to provisions which describe requirements for contractual relations and so forth.

The Norsok analysis project recommends that requirements for operational conditions in Norsok standards should be carefully assessed before being adopted. Requirements for company management in Norsok standards should be avoided. Furthermore, requirements on contractual relations in Norsok standards should also be avoided.

### *11.6.3 Development and formulation of Norsok standards*

All work related to Norsok standards must conform to Norsok A-001N ***Guidelines on developing and formulating Norsok standards*** (4), including the establishment, revision and withdrawal of Norsok standards.

Norsok A-001N *Guidelines on developing and formulating Norsok standards* provides definitions of the modal auxiliaries “shall”, “should”, “may” and “can”. All Norsok standards must use the same definitions. In other words, non-conformity with the definitions provided in Norsok A-001 is not permitted.

However, the Norsok analysis project has demonstrated that varying definitions of these modal auxiliaries are used in the Norsok standards. This is unfortunate. Even though the modal auxiliaries are clearly defined, a number of examples can be found of other formulations to specify requirements. Examples include “has to be” and “must”. All this can lead to confusion and a lack of clarity with regard to interpreting requirements specified in the Norsok standards.

The definitions of “shall”, “should”, “may” and “can” in Norsok A-001 derive from the definitions used by ISO/IEC. The following definitions are used in the latest published version of ***ISO/IEC Directives Part 2 section 3.3 Provisions*** (22). See table 4. It is important that compliance with the definitions given in table 4 is ensured in all work related to Norsok standards.

Table 4 – Definitions for “shall”, “should”, “may” and “can”
(Source: ISO/IEC Directives Part 2 - section 3.3 Provisions)

| |
|---|
| **3.3.3**<br>**Requirement (shall)**<br>expression in the content of a document conveying objectively verifiable criteria to be fulfilled and from which no deviation is permitted if compliance with the document is to be claimed<br><br>Note 1 to entry: Requirements are expressed using the verbal forms specified in Table 3. |
| **3.3.4**<br>**Recommendation (should)**<br>expression in the content of a document conveying a suggested possible choice or course of action deemed to be particularly suitable without necessarily mentioning or excluding others<br><br>Note 1 to entry: Recommendations are expressed using the verbal forms specified in Table 4.<br><br>Note 2 to entry: In the negative form, a recommendation is the expression that a suggested possible choice or course of action is not preferred but it is not prohibited. |
| **3.3.5**<br>**Permission (may)**<br>expression in the content of a document conveying consent or liberty (or opportunity) to do something<br><br>Note 1 to entry: Permissions are expressed using the verbal forms specified in Table 5. |
| **3.3.6**<br>**Possibility (can)**<br>expression in the content of a document conveying expected or conceivable material, physical or causal outcome |

## 11.7 The Norsok analysis project – further work

The Norsok owners will follow up the positions which have been developed for the various Norsok standards through the Norsok analysis project, and which are presented in chapters 10 and 12 of this report as well as in appendix A. This work will be pursued through the sector board petroleum industry, through increased management attention and resource allocation by the Norsok owners’ member companies, and through other industry initiatives.

One such initiative is KonKraft. This is a collaboration arena for Norwegian Oil and Gas, the Federation of Norwegian Industries, the Norwegian Shipowners’ Association and the LO as well as the United Federation of Trade Unions and the Norwegian Union of Industry and Energy Workers (Industry Energy), which are both LO members. KonKraft is intended to be an agenda-setter for national strategies in the petroleum sector and to work to maintain the competitiveness of the NCS so that Norway remains an attractive area for investment by the Norwegian and international oil and gas industry – including supplier companies and the maritime industry. KonKraft recently launched a new initiative on *Competitiveness – the changing NCS*. This will pursue such issues as standardisation, simplification and industrialisation.

## 12 REFERENCES

A number of references are cited in this report. The documents referenced are identified in a combination of bold and italic script followed by the reference number. This list is not complete.


(1) NS-EN 45120:2006
(2) ISO/IEC *Guide* 2:2004
(3) *Norsk sokkels konkurranseposisjon – Delrapport nr. 2 – Standardisering*, Submitted to the Ministry of Industry and Energy on 1 February 1995
(4) Norsok A-001N – *Retningslinjer for utvikling og utforming av Norsok-standards* (ICS 75.180.99)
(5) *Norsok Standards – Qualifications and Gap Analysis versus International Standard*s (2002)
*(6)* *Plan for implementation of Norsok standards into the international standards work* (2009)
*(7)* White Paper no 51 (1992–1993) – *On safety and the working environment in petroleum activities on the Norwegian continental shelf*
(8) Crown Prince Regent decree of 19 December 2002 on establishing the PSA
(9) Framework regulations
(10) Management regulations
(11) Facilities regulations
(12) Activity regulations
(13) Vienna Agreement
*(14)* IOGP – *Catalogue of international standards used in the petroleum and natural gas industries*, (IOGP no 362 – February 2012)
(15) IOGP – *Electrotechnical standards relevant for the oil and gas industry* (IOGP no 530 – March 2015)
(16) IOGP – *Standards and guidelines for well construction and well operations* (IOGP no 485 – June 2016)
(17) IOGP – *Material standards and committees for the international oil & gas industry* (IOGP no 421 – June 2009)
*(18)* IOGP – *Instrument & automation standards and committees for the international oil & gas industry* (IOGP no 427 – July 2010)
(19) IOGP – *Coatings standards and committees for the international oil & gas industry* (IOGP no 428 – June 2010)
(20) IOGP – *Regulators' use of standards* (IOGP no 426 – March 2010)
(21) IOGP – Position paper on the development and use of international standards (IOGP no 381 - May 2007)
(22) ISO/IEC *Directives Part 2 – section 3.3. - Provisions*
*(23)* Menon publication 39/2016 – *Krav som kostnadsdriver i norsk petroleumsindustri* (Menon report)
(24) PSA: *Dokumentasjonsprosjektet – Kartlegging av dokumentasjonsomfanget i petroleumsnæringen* 2015/611-01 (August 2016)
(25) Norwegian Oil and Gas: *Cost-driving factors – Company-specific requirements* (October 2016)
*(26)* University of Stavanger, MSc thesis by Håkon Kjerkreit: C*osts of not following Common Standards – A Case Study of Cost Implications of Using Customer Specific Requirements Instead of Industry Standards* (15 June 2016)

## APPENDIX A – EVALUATION OF EACH NORSOK STANDARD

| Conclusions Norsok C-001 Living quarters area | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | No alternative standards exist for this area. A common standard is cost-effective compared with company-specific requirements. The standard contributes to good quality and a high accommodation standard for facilities on the NCS. |
| **Competitiveness** | The standard is used internationally, and referenced in other countries' regulations. |
| **Safety** | The standard concentrates on comfort and quality in the living quarters, and not directly on safety. |
| **Comments** | Merger with Norsok C-002 should be considered. |

| Conclusions Norsok C-002 Architectural components and equipment | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | No alternative standards exist for this area. A common standard is cost-effective compared with company-specific requirements. The standard contributes to good quality and a high standard for fixed facilities on the NCS. |
| **Competitiveness** | The standard is regarded as important for suppliers who deliver to the petroleum industry in Norway.<br><br>Standardised solutions contribute to efficient maintenance. |
| **Safety** | The standard concentrates on the quality of the facility. Some architectural elements contribute to increased safety. |
| **Comments** | Merger with Norsok C-001 should be assessed. In the next revision, the standard should be assessed for greater flexibility – with, for example, fewer absolute requirements and more recommendations (should). |

| Conclusions Norsok C-004 Helicopter deck on offshore installations | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective |
| **Cost/benefit** | Norsok C-004 clarifies national and international requirements for designing and installing helidecks. The standard emphasises that the helideck design must be integrated with the overall design of the facility.<br><br>The standard otherwise contributes to identifying good and cost-effective solutions with a high safety standard. |
| **Competitiveness** | Use of C-004 is well established and helps Norwegian engineering companies and suppliers to become acquainted easily with the requirements which apply for helidecks on offshore facilities. Nevertheless, C-004 is unlikely to be the cause of any significant competitive distortions in the market. |
| **Safety** | The standard contributes to a high level of safety by facilitating safe and efficient helicopter operations.<br><br>C-004 distinguishes itself from other standards in the area by setting increased safety requirements for<br>• the deck size (DH=1.25xD)<br>• recessed gangway. |
| **Comments** | International standards exist for helidecks (ICAO) and for helidecks on ships (DNV GL). None of these could readily replace C-004 as a design standard for petroleum facilities. |

| Conclusions Norsok D-001 Drilling facilities | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | D-001 makes the selection of drilling equipment more efficient compared with having to deal with a number of separate standards. |
| **Competitiveness** | The standard is not considered to distort competition.<br><br>The standard provides a good tool for an efficient Norwegian petroleum industry. |
| **Safety** | The standard contributes to maintaining a high level of safety without undesirable drilling and well incidents. |
| **Comments** | Norsok D-001 should until further be retained as a Norsok standard but since corresponding or overlapping international standards do not exist internationalisation should be sought.<br><br>Virtually all the shipping companies use an alternative (DNV-OS-E101) to D-001 (even though this is the primary reference in the HSE regulations for petroleum operations). |

| Conclusions Norsok D-002 Well intervention equipment | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | The standard describes best industry practice in the area. |
| **Competitiveness** | The standard is not considered to distort competition.<br><br>The standard provides a good tool for an efficient Norwegian petroleum industry and does not contain special Norwegian requirements of any significance. |
| **Safety** | The standard contributes to maintaining a high level of safety without undesirable drilling and well incidents. |
| **Comments** | No international standard exists which covers the whole scope of this Norsok standard. |

| Conclusions Norsok D-007 Well testing system | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | Having updated requirements for well testing concentrated in a single Norsok standard is cost-effective. |
| **Competitiveness** | Because few discovery wells are tested (new technology permits formation testing while tripping), this standard will not have the effect of distorting competition. |
| **Safety** | The background for the standard is to concentrate attention on safety (Alarp) and prudent operation. |
| **Comments** | No international standard exists which covers the full scope of this Norsok standard. |

| Conclusions Norsok D-010 Well integrity in drilling and well operations | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>Should be given priority for internationalisation. |
| **Cost/benefit** | Having all updated requirements for well integrity concentrated in a single Norsok standard is cost-effective compared with having to deal with some 50 different international standards. |
| **Competitiveness** | Norsok D-010 is extensively used by both operators and suppliers in connection with well design and with planning and executing well activities and operations.<br><br>Some companies have adopted the standard internationally, and other nations reference it.<br><br>Norsok D-010 accordingly represents a recognised standard in the petroleum industry, also internationally. |
| **Safety** | Well integrity is defined as "the application of technical, operational and organisational solutions to reduce risk of uncontrolled release of formation fluids throughout the life cycle of a well". Well integrity is crucial for avoiding serious well incidents. The standard therefore makes a very substantial contribution to maintaining an acceptable level of safety. |
| **Comments** | Internationalisation of D-010 could mean limited opportunities to retain all normative requirements unchanged (in other words, "shall"). |

| Conclusions Norsok E-001 Electrical systems | |
|---|---|
| **Recommendation** | Short-term perspective<br>The standard will be withdrawn.<br><br>Long-term perspective |
| **Cost/benefit** | |
| **Competitiveness** | |
| **Safety** | |
| **Comments** | The standard will be withdrawn and transferred to the Norwegian Electrotechnical Committee (NEK) when the current revision has resulted in a new approved version. |

| **Conclusions Norsok H-003 Heating, ventilation and air conditioning (HVAC) and sanitary systems** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>All or part of the standard should be incorporated as improvements to an existing international standard. |
| **Cost/benefit** | Norsok H-003 builds on ISO 15138, but contains special Norwegian requirements with regard to HVAC systems. |
| **Competitiveness** | |
| **Safety** | H-003 helps to maintain the level of safety on the NCS by describing requirements for the ventilation strategy for firefighting, active smoke control and requirements for passive fire protection in the ventilation system. |
| **Comments** | The scope of H-003 should be assessed in relation to the current revision of ISO 15138 *Offshore production installations - Heating, ventilation and air-conditioning*. The decision to revise ISO 15138 was taken because the current version dates from 2007. |

| **Conclusions Norsok I-001 Field instrumentation** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective |
| **Cost/benefit** | Norsok I-001 describes minimum technical solutions, while company-specific supplementary requirements are needed.<br><br>New projects benefit more from Norsok I-001 than existing facilities, where established solutions impose restrictions. |
| **Competitiveness** | Norsok I-001 improves the competitiveness of Norwegian suppliers. |
| **Safety** | The standard is less relevant for the level of safety. |
| **Comments** | Technical advances in the instrumentation field call for quick and frequent updates.<br><br>Retaining the standard is conditional on the operator companies agreeing whether it is important to have an industry standard in this area, and making the necessary resources available for revision work in the operator companies, the engineering companies and the rest of the supplies industry. |

| Conclusions Norsok I-002 Safety and automation system (SAS) | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective |
| **Cost/benefit** | An updated Norsok I-002 contributes to more standardised requirements and implementation in the value chain, including the operator, suppliers and engineering companies involved with oil and gas the NCS. This provides benefits for both projects and operations.<br><br>Choosing not to use the SAS standard would mean the development of further project- and supplier-specific solutions, which make reuse more difficult. That would reduce quality and increase costs.<br><br>New projects benefit more from Norsok I-002 than existing facilities, where established solutions impose restrictions. |
| **Competitiveness** | Norsok I-002 improves the competitiveness of Norwegian suppliers. |
| **Safety** | I-002 contributes to an acceptable level of safety for equipment on the NCS. |
| **Comments** | Technical advances in the instrumentation field call for quick and frequent updates. The I-002 standard was last updated in 2001.<br>It has therefore been replaced in practice (by Statoil TR3034) on the NCS.<br><br>If the standard is to be retained, the operator companies must agree that an industry standard in this area is important, and the necessary resources must be allocated for revision work by operator companies, engineering companies and the rest of the supplies industry. |

| Conclusions Norsok I-005 System control diagram | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision should be given priority.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | I-005 helps to standardise and visualise programming functions and input to make them more easily accessible for disciplines other than automation. That provides an efficiency gain for projects and in operation.<br><br>Alternatively, project- and supplier-specific solutions would be developed which make reuse more difficult. That would reduce quality and increase costs. |
| **Competitiveness** | Norsok I-005 offers little scope for interpretation and misunderstandings. That provides simplification and efficiency gains in all phases of the control system's effective life.<br><br>Norsok I-005 enhances the quality of applications and thereby increases the availability of the facility because the standard permits cross-disciplinary reviews of performance. |
| **Safety** | I-005 contributes to an acceptable level of safety for equipment on the NCS. Standardised functions offer fewer opportunities for interpretations of performance.<br><br>A standardised method for visualising and implementing PCS and PSD performance helps to enhance safety and permits continuous improvement. |
| **Comments** | Work directed at IEC TC 65 for internationalisation has begun.<br><br>The standard could be more widely used if it can be converted into an IEC standard. |

| Conclusions Norsok I-106 Fiscal metering systems for hydrocarbon liquid and gas | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | Norsok I-106 encourages the identification of cost-effective solutions and specifically mentions the assessment of low life-cycle costs and solutions which reduce weight. The standard also provides guidance on which analyses should be conducted in order to arrive at cost-effective solutions. |
| **Competitiveness** | Use of I-106 is well established, and helps to give Norwegian suppliers and companies a competitive edge on the NCS. Norsok I-106 is not considered to hamper technological development or the use of new technology. |
| **Safety** | Not relevant. |
| **Comments** | No international standards exist with cover the whole scope of this Norsok standard.<br><br>The standard can be assessed as the basis of an international standard on systems for fiscal metering and allocation of oil and gas production.<br><br>The standard should be updated to cover metering systems which use multiphase flow measurement or other methods for allocating production. |

| Conclusions Norsok L-001 Piping and valves | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision should be given priority.<br><br>Long-term perspective |
| **Cost/benefit** | Norsok L-001 contributes to good technical and cost-effective solutions in the petroleum industry.<br><br>L-001 encourages the use of permitted variations in pressure and temperature in the facility, and thereby provides opportunities for reducing weight and consequently costs. However, too many variations could be a cost driver. |
| **Competitiveness** | L-001 is well established and helps to give Norwegian suppliers and companies a competitive edge on the NCS.<br><br>Norsok L-001 is regarded as a good and comprehensible standard which contributes to efficient design of pipes, pipe components and piping systems. Good knowledge and frequent utilisation of the standard gives engineering companies and system suppliers a competitive edge.<br><br>The biggest benefit lies in the standardisation of requirements for components and the use of these. The choice of components in the standard ensures that operating costs are kept low and that regularity is high. |
| **Safety** | Norsok L-001 contributes to an acceptable level of safety. |
| **Comments** | Norsok L-001 should be retained as a Norsok standard.<br><br>No international standards cover the scope of L-001 in a more user-friendly manner. |

| **Conclusions Norsok L-002 Piping system layout, design and structural analysis** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective |
| **Cost/benefit** | Norsok L-002 contributes to good technical and cost-effective solutions in the petroleum industry. |
| **Competitiveness** | Since the requirements described in L-002 are not adequately covered in other standards, it contributes to the competitiveness of Norwegian industry.<br><br>The standard is used by the operators, engineering companies and supplier companies. L-002 is simple to understand, which contributes to its effective use in design and fabrication. |
| **Safety** | Norsok L-002 contributes to an acceptable level of safety by describing requirements for the design of pipes and piping system so that these can handle the loads they are subjected to. |
| **Comments** | Norsok L-002 has interfaces with several other Norsok and international standards and codes, both for piping and for other disciplines. This is an experience-based standard which supplements the other standards/codes in a positive way with necessary guidelines for a good design.<br><br>The standard contains performance-based and prescriptive requirements for design, structural analysis and installation of pipes and piping systems, and its appendix describes methods for fatigue in piping systems.<br><br>These requirements are regarded as supplementary to ASME B31.3, and are not covered in other standards.<br><br>L-002 was updated in July 2016 and is adapted to the latest version of Norsok P-002 as well as other relevant standards. |

| Conclusions Norsok L-CR-003 (L-003) Piping details | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision should be given priority.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | Norsok L-003 contributes to good technical and cost-effective solutions in the petroleum industry. L-003 is simple to understand, which contributes to its effective application in design and fabrication. However, too many variants could have a cost-driving effect. |
| **Competitiveness** | Norsok L-003 is regarded as a good and clear standard which contributes to efficient design of piping details. Good knowledge and frequent utilisation of the standard give engineering companies and system suppliers a competitive edge. |
| **Safety** | Norsok L-003 contributes to efficient and predictable design of piping details, and thereby to an acceptable level of safety. |
| **Comments** | Norsok L-003 comprises requirements for the design of piping details and establishes interfaces with other disciplines, such as instrumentation, stress calculation and structural.<br><br>Norsok L-003 comprises a set of piping details used together with Norsok L-001, Norsok L-002 and Norsok P-002 for the design of piping details in a piping system.<br><br>Norsok L-003 should be assessed as an international standard for offshore facilities.<br><br>No information is available on the possible existence of international standards which address the area covered by L-003. |

| **Conclusions Norsok L-004 Piping, fabrication, installation, flushing and testing** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective |
| **Cost/benefit** | Norsok L-004 contributes to good technical and cost-effective solutions in the petroleum industry. |
| **Competitiveness** | Use of Norsok L-004 is well established and helps to give Norwegian suppliers and companies a competitive edge on the NCS. |
| **Safety** | Norsok L-004 helps to ensure predictable technical solutions for piping systems and makes a positive contribution to an acceptable level of safety. |
| **Comments** | The standard covers fabrication, installation, flushing, pressure-testing, cleaning and colour-coding of piping systems in the petroleum sector.<br><br>Piping systems on NCS facilities largely conform to the ASME B31.3 code and relevant component standards in the ASME system. Norsok L-004 has been developed with experience related to the ASME system. |

| Conclusions Norsok L-005 Compact flanged connections | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>All or part of the standard should be incorporated as improvements in an existing international standard. |
| **Cost/benefit** | Norsok L-005 contributes to good technical and cost-effective solutions. |
| **Competitiveness** | A number of benefits are offered by using ISO 27509 and Norsok L-005 for compact flanges compared with ASME flanges, for example.<br><br>Using Norsok L-005 as a supplementary standard with ISO 27509 for compact flanges also provides a number of benefits. |
| **Safety** | Norsok L-005 contributes to an acceptable level of safety in the petroleum industry. |
| **Comments** | A substantial part of Norsok L-005 was internationalised in 2012 and exists today as a separate standard with the designation NS-EN ISO 27509. Norsok L-005 was revised in parallel with the publication of ISO 27509. At present, L-005 contains only one chapter which was not transferred ISO 27509.<br><br>What remains in L-005 are requirements which give suppliers the opportunity to design supplier-specific solutions for compact flanged connections with reference to L-005.<br><br>In the longer term, L-005 should be incorporated in ISO 27509 and can then be withdrawn. |

| Conclusions Norsok M-001 Material selection | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>All or part of the standard can be incorporated as improvements in an existing international standard. |
| **Cost/benefit** | Norsok M-001 reflects current practice in the industry for material selection on the NCS. The trend has been towards increased use of stainless material solutions. This has been regarded as the most cost-effective approach overall, even if it has increased investment costs in a number of cases. |
| **Competitiveness** | Knowledge of the Norsok M series has been a competitive advantage. In particular, it has been a requirement when carrying out work for developments on the NCS. Such knowledge has also proved necessary for projects outside the NCS, in that the oil companies have incorporated information from Norsok in their international activities. |
| **Safety** | No negative incidents have occurred on the NCS which can be attributed to Norsok M-001, M-503 or M-506. It is probably true to say that the number of leaks has been reduced through the introduction of these standards, which have contributed to consistent, effective and safe solutions. |
| **Comments** | Norsok M-001 provides clarifications of and to some extent supplementary requirements for international standards and thereby represents an alternative to company-specific requirements.<br><br>ISO 21457, published in 2010, builds by and large on Norsok M-001. |

| **Conclusions Norsok M-004 Piping and equipment insulation (previously R-004)** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok - revision should be given priority.<br><br>Long-term perspective |
| **Cost/benefit** | |
| **Competitiveness** | |
| **Safety** | |
| **Comments** | Expert group M has taken over this standard from expert group R, making it a new M standard. A lot is happening in this technical field, and the standard should therefore be given priority for revision. |

| **Conclusions Norsok M-101 Structural steel fabrication** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>All or part of the standard can be incorporated as improvements in an existing international standard. |
| **Cost/benefit** | Norsok M-101 contributes together with Norsok N-004, M-120 and M-001 to good technical and cost-effective solutions in the petroleum industry. The standard is formulated in a way which has not increased costs for the sector.<br><br>Norsok M-101 has a big potential for cost savings through the use of engineering-critical assessment (ECA), which assumes that fracture mechanics testing is included in the qualification of welding procedures. |
| **Competitiveness** | Use of Norsok M-101 is well established with both Norwegian and foreign manufacturers.<br><br>Knowledge of Norsok M-101 increases opportunities for winning assignments internationally. |
| **Safety** | Norsok M-101 contributes in combination with Norsok N-004, M-120 and M-001 to ensuring a good level of safety for offshore structures on the NCS. |
| **Comments** | M-101 is well developed and applicable for efficient fabrication of offshore steel structures. Particular emphasis is given in the standard to requirements for and qualification of welding procedures as well as the execution of welding and control.<br><br>Norsok M-101 is specified in ISO 19902 as a relevant fabrication standard.<br><br>Norsok M-101 should be revised following the revision of ISO 19902 *Fixed steel offshore structures*. Important Norwegian contributions have been made to ISO 19902. M-120 *Material data sheets for structural steel* should be simplified and harmonised with the current revision of ISO 19902. |

| Conclusions Norsok M-102 Structural aluminium fabrication | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective |
| **Cost/benefit** | Norsok M-102 contributes to good technical and cost-effective solutions in the petroleum industry. The standard is formulated in a way which has not increased costs for the sector. |
| **Competitiveness** | Use of Norsok M-102 is well established with both Norwegian and foreign manufacturers.<br><br>The M standards are updated regularly in line with technological developments. A possible conversion to ISO could involve increased costs because each company must define its requirements and options in separate technical specifications.<br><br>Knowledge of Norsok M-102 increases opportunities for winning assignments internationally. |
| **Safety** | Norsok M-102 contributes to a good level of safety in combination with Norsok M-120. |
| **Comments** | Norsok M-102 represents a good application of EN 1090-3 for fabrication of aluminium structures, but has a potential for improvement. Control requirements have been simplified.<br><br>Norsok M-102 defines supplementary requirements and options in relation to EN 1090-3. The design of aluminium structures must accord with EN 1999, and materials must accord with Norsok M-121. |

| **Conclusions Norsok M-120 Material data sheets for structural steel** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>All or part of the standard can be incorporated as improvements in an existing international standard. |
| **Cost/benefit** | Norsok M-120 contributes to good technical and cost-effective solutions in the petroleum industry. The standard is formulated in a way which has not increased costs for the sector. |
| **Competitiveness** | Use of Norsok M-120 is well established with Norwegian fabricators and wholesalers, as well as with foreign manufacturers.<br><br>Knowledge of Norsok M-120 increases opportunities for winning assignments internationally. |
| **Safety** | Norsok M-120 contributes to ensuring a good safety level in combination with Norsok N-004 and M-101. |
| **Comments** | Norsok M-120 is a collection of material data sheets for various products (plates, profiles, and welded or seamless pipes) and different material grades as defined in specific EN standards. Material grades are related to the steel quality level (SQL) as defined in Norsok N-004.<br><br>Norsok M-120 is specified in ISO 19902 as a relevant material specification. M-120 *Material data sheets for structural steel* should be simplified and harmonised with the current revision of ISO 19902. |

| **Conclusions Norsok M-121 Aluminium structural material** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective |
| **Cost/benefit** | Norsok M-121 contributes together with Norsok M-102 to good technical and cost-effective solutions in the petroleum industry. The standard is formulated in a way which has not increased costs for the sector. |
| **Competitiveness** | Use of Norsok M-121 is well established with Norwegian fabricators and wholesalers, as well as with foreign manufacturers.<br><br>The M standards are updated regularly in line with technological developments. A possible conversion to ISO could involve increased costs because each company must define its requirements and options in separate technical specifications.<br><br>Knowledge of Norsok M-102 increases opportunities for winning assignments internationally. |
| **Safety** | Norsok M-121 contributes to ensuring a good level of safety in combination with Norsok M-102. |
| **Comments** | Norsok M-121 contains a number of material data sheets for products and grades in defined EN standards, with relevant options in these standards specified. |

| Conclusions Norsok M-122 Cast structural steel | |
|---|---|
| **Recommendation** | <u>Short-term perspective</u><br>Retained as Norsok.<br><br><u>Long-term perspective</u> |
| **Cost/benefit** | Norsok M-122 contributes to good technical and cost-effective solutions in the petroleum industry. The standard is formulated in a way which has not increased costs for the sector. |
| **Competitiveness** | Norsok M-122 is a well-established standard in both the Norwegian fabrication industry and internationally (Korea, Japan and a number of European countries).<br><br>The M standards are updated regularly in line with technological developments. A possible conversion to ISO could involve increased costs because each company must define its requirements and options in separate technical specifications.<br><br>Knowledge of Norsok M-122 increases opportunities for winning assignments internationally. |
| **Safety** | Norsok M-122 contributes to ensuring a good level of safety in combination with Norsok N-004 and M-101. |
| **Comments** | Norsok M-122 defines requirements for the qualification of foundries, and for deliveries of cast steel for critical components in offshore structures. The standard comprises two sections, one of which covers qualification of foundries while the other deals with the production of castings. However, the two sections are integrated since production testing can form part of the foundry's qualification.<br><br>No duplicate international standards exist for the area covered by Norsok M-122. |

| Conclusions Norsok M-123 Forged structural steel | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective |
| **Cost/benefit** | Norsok M-123 contributes to good technical and cost-effective solutions in the petroleum industry. The standard is formulated in a way which has not increased costs for the sector. |
| **Competitiveness** | Norsok M-123 is a well-established standard in both the Norwegian fabrication industry and internationally (Korea, Japan and a number of European countries).<br><br>The M standards are updated regularly in line with technological developments. A possible conversion to ISO could involve increased costs because each company must define its requirements and options in separate technical specifications.<br><br>Knowledge of Norsok M-123 increases opportunities for winning assignments internationally. |
| **Safety** | Norsok M-123 contributes to ensuring a good level of safety in combination with Norsok N-004 and M-101. |
| **Comments** | Norsok M-123 defines requirements for the qualification of foundries, and for deliveries of forged steel for critical components in offshore structures. The standard comprises two sections, one of which covers qualification of foundries while the other deals with the production of forgings. However, the two sections are integrated since production testing can form part of the foundry's qualification.<br><br>No duplicate international standards exist for the area covered by Norsok M-123. |

| **Conclusions Norsok M-501 Surface preparation and protective coating** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | Norsok M-501 contributes to good technical and cost-effective solutions in the petroleum industry. The standard is formulated in a way which has not increased costs for the sector. |
| **Competitiveness** | M-501 is well established in Norway and with key suppliers to the NCS. International equipment suppliers are also familiar with the standard.<br><br>Knowledge of Norsok M-501 can be a competitive advantage. In particular, it has been important for executing assignments in developments on the NCS. Such knowledge has also proved necessary in projects outside the NCS, in that the oil companies have incorporated information from Norsok in their international activities. |
| **Safety** | Norsok M-501 contributes to a good level of safety. The standard has also devoted attention to working environment requirements for surface treatment. |
| **Comments** | No international standard exists at present which could replace M-501. Use of other standards would require a commitment by the oil company, EPC contractors and suppliers to put relevant requirements and clarifications in place.<br><br>It is important to note that requirements for surface treatment must be tailored to the climatic and operating conditions in the location where the facilities are to be constructed. Norsok M-501 is therefore tailored to the NCS. An international standard would need to have differentiated requirements depending on where the facility is to be constructed. |

| Conclusions Norsok M-503 Cathodic protection | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>All or part of the standard can be incorporated as improvements in an existing international standard. |
| **Cost/benefit** | Norsok M-503 is not considered to be significant for costs. |
| **Competitiveness** | Knowledge of the Norsok M series has been a competitive advantage. In particular, it has been a requirement for carrying out work in developments on the NCS. Such knowledge has also proved necessary in projects outside the NCS, in that the oil companies have incorporated information from Norsok in their international activities. |
| **Safety** | No negative incidents have occurred on the NCS which can be attributed to Norsok M-001, M-503 or M-506. It is probably true to say that the number of leaks has been reduced through the introduction of these standards, which have contributed to consistent, effective and safe solutions. |
| **Comments** | Norsok M-503 provides clarifications of and to some extent supplementary requirements to international standards, and thereby represents an alternative to company-specific requirements. |

| Conclusions Norsok M-506 $CO_2$ corrosion rate calculation model | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective |
| **Cost/benefit** | Norsok M-506 is not considered to be significant for costs. |
| **Competitiveness** | Knowledge of the Norsok M series has been a competitive advantage. In particular, it has been a requirement for carrying out work related to developments on the NCS. Such knowledge has also proved necessary in projects outside the NCS in that the oil companies have incorporated information from Norsok in their international activities. |
| **Safety** | No negative incidents have occurred on the NCS which can be attributed to Norsok M-001, M-503 or M-506. It is probably true to say that the number of leaks has been reduced through the introduction of these standards, which have contributed to consistent, effective and safe solutions. |
| **Comments** | |

| **Conclusions Norsok M-601 Welding and inspection of piping** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>All or part of the standard should be incorporated as improvements in an existing international standard. |
| **Cost/benefit** | Norsok M-601 contributes to good technical and cost-effective solutions in the petroleum industry. The standard is formulated in a way which has not increased costs for the sector. |
| **Competitiveness** | Norsok M-601 is well established both in the Norwegian fabrication industry and with foreign suppliers to Norway's petroleum sector. |
| **Safety** | Norsok M-601 contributes in combination with L-004, M-630 and M-001 to a good level of safety. |
| **Comments** | Norsok M-601 is limited to piping which accords with ASME B31.3 and accordingly applies primarily to equipment on the platform topsides and in onshore facilities. However, it is equally relevant for subsea and onshore facilities which form part of a transport system. Such installations are usually based on ASME B31.4, B31.8 and B31.12. |

| **Conclusions Norsok M-622 Fabrication and installation of GRP piping systems** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Standard to be withdrawn.<br><br>Long-term perspective |
| **Cost/benefit** | |
| **Competitiveness** | |
| **Safety** | |
| **Comments** | Withdrawal of this standard has already been proposed by expert group M. The content in Norsok M-622 is being transferred to ISO 14692. |

| **Conclusions Norsok M-630 Material data sheets and element data sheets for piping** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>All or part of the standard should be incorporated as improvements in an existing international standard. |
| **Cost/benefit** | Norsok M-630 contributes to good technical and cost-effective solutions in the petroleum industry. The standard is formulated in a way which has not increased costs for the sector. |
| **Competitiveness** | Norsok M-630 is applied in an effective way by both the Norwegian fabrication industry and foreign suppliers to Norway's petroleum sector. |
| **Safety** | Norsok M-630 contributes to a good level of safety in combination with Norsok M-650. |
| **Comments** | Norsok M-630 refers to relevant ASME standards. An assessment of the relevant material data sheets will be conducted in order to achieve harmonisation with the EU's pressure directive.<br><br>When ISO 17782 has been completed, M-630 material data sheets for duplex materials should refer to ISO 17782 for testing and acceptance criteria.<br><br>Norsok M-630 has been used as input for establishing an IOGP standard (see JIP 33). Norsok M-630 should be assessed once this IOGP standard has been published. |

| **Conclusions Norsok M-650 Qualification of manufacturers of special materials** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Standard to be withdrawn.<br><br>Long-term perspective |
| **Cost/benefit** | Norsok M-650 contributes to good technical and cost-effective solutions in the petroleum industry. The standard is formulated in a way which has not increased costs for the sector. |
| **Competitiveness** | Norsok M-650 is applied in an effective way by both the Norwegian fabrication industry and foreign suppliers to Norway's petroleum sector. |
| **Safety** | Norsok M-650 contributes to a good level of safety. |
| **Comments** | Norsok M-650 represents an integrated combination with Norsok M-001 and M-630 as well as other Norsok standards where special materials are utilised.<br><br>A draft of ISO 17782.2 is currently at the consultation stage and is based in many respects on Norsok M-650. Replacing M-650 with the new ISO 17782 should be a clear ambition, but responsibilities relating to the qualifying body need to be clarified. A risk also exists that ISO 17782 could increase costs because induction and cold bending are included. These considerations must be clarified before M-650 can be withdrawn. |

| **Conclusions Norsok M-710 Qualification of non-metallic materials and manufacturers – Polymers** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>All or part of the standard should be incorporated as improvements in an existing international standard. |
| **Cost/benefit** | Norsok M-710 contributes to good technical and cost-effective solutions in the petroleum industry. The standard is formulated in a way which has not increased costs for the sector. |
| **Competitiveness** | Use of M-710 is well established and helps to give Norwegian suppliers and companies a competitive edge in operations on the NCS.<br><br>Knowledge of M-710 increases opportunities for winning assignments internationally. |
| **Safety** | Norsok M-710 contributes to a good level of safety. |
| **Comments** | The ISO 23936-1 and 23936-2 standards are based on M-710. So the scope of M-710 has been reduced to accord with the development of the two ISO standards.<br><br>Efforts should be made to include M-710 wholly or in part in the next revision of ISO 23936-2 *Non-metallic materials in contact with media related to oil and gas production - Part 2: Elastomers.* |

| **Conclusions Norsok N-001 Integrity of offshore structures** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>All or part of the standard can be incorporated as improvements in an existing international standard. |
| **Cost/benefit** | Norsok N-001, 003, 004, 005 and 006, together with M-001, 101 and 120, contribute to good technical and cost-effective solutions in the petroleum industry and are recommended for retention.<br><br>The N standards in themselves have not contributed to increased costs in the industry. |
| **Competitiveness** | Use of the N standards is well established and helps to give Norwegian suppliers and companies a competitive edge in operations on the NCS. The N standards are updated regularly in line with technological developments. |
| **Safety** | The standard has helped to ensure that no incidents have been experienced on the NCS involving the failure of loadbearing structures as a result of errors/deficiencies in the N series. |
| **Comments** | Can be retained as a Norsok standard or as a Norwegian annex to ISO 19900 *General requirements for offshore structures*. |

| **Conclusions Norsok N-002 Collection of metocean data** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Standard to be withdrawn.<br><br>Long-term perspective |
| **Cost/benefit** | |
| **Competitiveness** | |
| **Safety** | |
| **Comments** | The standard is already in the process of being transferred to ISO 19901-1. |

| Conclusions Norsok N-003 Actions and action effects | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>All or part of the standard can be incorporated as improvements in an existing international standard. |
| **Cost/benefit** | Norsok N-001, 003, 004, 005 and 006, together with M-001, 101 and 120, contribute to good technical and cost-effective solutions in the petroleum industry and are recommended for retention.<br><br>The N standards in themselves have not contributed to increased costs in the industry. |
| **Competitiveness** | Use of the N standards is well established and helps to give Norwegian suppliers and companies a competitive edge in operations on the NCS. The N standards are updated regularly in line with technological developments. |
| **Safety** | The standard has helped to ensure that no incidents have been experienced on the NCS involving the failure of loadbearing structures as a result of errors/deficiencies in the N series. |
| **Comments** | N-003 should be simplified and harmonised as far as possible with ISO-19901-1 *Specific requirements for offshore structures - Part 1: Metocean design and operating considerations*. The goal should be to phase out N-003 in the same way as the N-002 *Metocean* and G-001 *Marine soil investigations* standards. |

| **Conclusions Norsok N-004 Design of steel structures** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>All or part of the standard can be incorporated as improvements in an existing international standard. |
| **Cost/benefit** | Norsok N-001, 003, 004, 005 and 006, together with M-001, 101 and 120, contribute to good technical and cost-effective solutions in the petroleum industry and are recommended for retention.<br><br>The N standards in themselves have not contributed to increased costs in the industry. |
| **Competitiveness** | Use of the N standards is well established and helps to give Norwegian suppliers and companies a competitive edge in operations on the NCS. The N standards are updated regularly in line with technological developments. |
| **Safety** | The standard has helped to ensure that no incidents have been experienced on the NCS involving the failure of loadbearing structures as a result of errors/deficiencies in the N series. |
| **Comments** | N-004 should provide the starting point for further work on improving ISO 19902 *Fixed steel offshore structures* and 19901-3 *Specific requirements for offshore structures - Part 3 Topsides structure*. |

| Conclusions Norsok N-005 Condition monitoring of loadbearing structures | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision should be given priority.<br><br>Long-term perspective |
| **Cost/benefit** | Norsok N-001, 003, 004, 005 and 006, together with M-001, 101 and 120, contribute to good technical and cost-effective solutions in the petroleum industry and are recommended for retention.<br><br>The N standards in themselves have not contributed to increased costs in the industry. |
| **Competitiveness** | Use of the N standards is well established and helps to give Norwegian suppliers and companies a competitive edge in operations on the NCS. The N standards are updated regularly in line with technological developments. |
| **Safety** | The standard has helped to ensure that no incidents have been experienced on the NCS involving the failure of loadbearing structures as a result of errors/deficiencies in the N series. |
| **Comments** | |

| **Conclusions Norsok N-006 Assessment of structural integrity for existing offshore loadbearing structures** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>All or part of the standard can be incorporated as improvements in an existing international standard. |
| **Cost/benefit** | Norsok N-001, 003, 004, 005 and 006, together with M-001, 101 and 120, contribute to good technical and cost-effective solutions in the petroleum industry and are recommended for retention.<br><br>The N standards in themselves have not contributed to increased costs in the industry. |
| **Competitiveness** | Use of the N standards is well established and helps to give Norwegian suppliers and companies a competitive edge in operations on the NCS. The N standards are updated regularly in line with technological developments. |
| **Safety** | The standard has helped to ensure that no incidents have been experienced on the NCS involving the failure of loadbearing structures as a result of errors/deficiencies in the N series. |
| **Comments** | |

| Conclusions Norsok P-002 Process system design | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>All or part of the standard should be incorporated as improvements in an existing international standard. |
| **Cost/benefit** | Norsok P-002 contributes to good technical and cost-effective solutions in the petroleum industry. However, certain elements in the standard could be cost drivers. |
| **Competitiveness** | Norsok P-002 is regarded as a good and comprehensible standard which describes the design of process plants and provides performance-based requirements for process and utility systems.<br><br>Use of P-002 is well established and helps to give Norwegian suppliers and companies a competitive edge in operations on the NCS. |
| **Safety** | Norsok P-002 plays a key role when designing safety systems for process plants. The standard contributes to an acceptable level of safety by ensuring that process systems and equipment are dimensioned for the loads they can be exposed to, and can be shut down in a reliable manner.<br><br>The standard sets requirements for Hazop. |
| **Comments** | Efforts should be made to incorporate elements related to process safety, from the normative part of the standard, in international standards. |

| Conclusions Norsok R-001 Mechanical equipment | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective |
| **Cost/benefit** | Retaining the standard would be appropriate for certain smaller operators on the NCS in order to ensure that special Norwegian requirements are met in a cost-effective manner. Where certain projects are concerned, a withdrawal of R-001 could lead to increased use of time/costs in preparing specifications and follow-up in the detail engineering phase, and could pose a greater risk of upgrading/conversion late in the design phase or in the operation phase.<br><br>Norsok R-001 provides a good basis for "right first time" application, which is regarded as an important factor in reducing costs. |
| **Competitiveness** | Use of R-001 is well established and helps to give Norwegian suppliers and companies a competitive edge in operations on the NCS. Norsok R-001 is not considered to hinder technological development and the use of new technology, particularly technology related to requirements for the natural environment. |
| **Safety** | The standard contributes to an acceptable level of safety by ensuring that mechanical systems and equipment are designed to cope with the loads they are exposed to. |
| **Comments** | The standard refers to ISO, API and other standards which cover requirements for specific mechanical equipment and systems, and contains supplementary requirements for these. This makes the standard useful because it brings together relevant standards for mechanical equipment and systems. That applies particularly for smaller operators.<br><br>The standard contains data sheets which are well established in the industry, particularly in relation to equipment suppliers.<br><br>The standard is also important for clarifying requirements related to the natural environment. |

| Conclusions Norsok R-002 Lifting equipment | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision should be given priority.<br><br>Long-term perspective |
| **Cost/benefit** | Norsok R-002 sets special Norwegian requirements in certain areas which impose substantial costs. These special requirements are particularly burdensome for mobile units which require an AoC for operating on the NCS. Such units find they must convert cranes and other lifting equipment as well as rescue and evacuation equipment.<br><br>International suppliers of lifting equipment claim that products delivered pursuant to Norsok R-002 have a mark-up of 10-20 per cent.<br><br>Norsok R-002 contains a number of special Norwegian prescriptive requirements which impose substantial costs, even though both the Norsok standard and the Norwegian machinery regulations emphasise a risk-based approach. |
| **Competitiveness** | The standard sets special Norwegian requirements for equipment and follow-up of equipment covered by this standard. That affects competitiveness because:<br><br>- foreign and Norwegian suppliers of lifting equipment must differentiate their products for the Norwegian market, which hinders competition over deliveries to Norwegian operators<br><br>- rig contractors face a substantial increase in investment costs when moving to the NCS, restricting the movement of rigs between the Norwegian and foreign sectors.<br><br>The requirement that lifting equipment must be certified by an enterprise of competence, for example, could have a negative effect on costs for procuring and following up such equipment and accessories in Norway. |
| **Safety** | Norsok R-002 contributes to maintaining a high level of safety.<br><br>Attention is also paid to conditions which can affect the working environment, personal safety and the ability of the operator to handle an incident.<br><br>The standard provides a good description of how risk analyses should document an acceptable level of safety. |
| **Comments** | The standard should be revised in order to simplify it and reduce cost-driving requirements, providing safety is taken care of.<br><br>Norsok R-002 revision 3 has been drawn up in part to reduce cost-driving requirements where a safety benefit cannot be documented. |

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| | Norwegian Shipowners Association:<br>Pursuant to section 3 of the framework regulations, mobile offshore units (MOUs) have the opportunity to use maritime regulations. This opportunity is restricted by section 1 of the facilities regulations on scope, which introduces limitations in a number of areas. One of these is lifting equipment. That means in practice that Norsok R-002 *Lifting equipment* has been applied to MOUs. In those cases where significant differences exist between fixed and mobile units, and where use of the prescribed solution in Norsok yield marginal safety differences, the opportunity should be provided for writing these differences directly into the Norsok R-002 standard. This should also be possible in the event of general differences in principle. The consequences of regulating in this manner will be to make it possible to participate in those parts of the standard which provide a significant safety benefit while simultaneously allowing exceptions to be made for those parts which have a substantial cost side with a marginal associated safety benefit. |

| Conclusions Norsok R-003 Safe use of lifting equipment | |
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| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision should be given priority.<br><br>Long-term perspective |
| **Cost/benefit** | Norsok R-003 contains extensive prescriptive competence requirements which have become normative for the industry by being referenced in the regulations. This has a cost-driving effect without it being possible to document a proportionate safety gain from these extensive competence requirements. |
| **Competitiveness** | |
| **Safety** | The standard has helped to raise the level of safety in the performance of lifting operations in the petroleum industry. An operational standard like R-003 provides a safe and standardised way of conducting lifting operations on the NCS. |
| **Comments** | Norsok R-003 has contributed to a substantial raising of the safety level for lifting operations in the petroleum industry. It contains a main section (the actual standard) and appendices. The actual standard contains operational and administrative requirements, while a number of competence requirements and training curricula are collected in appendix B. This appendix is referenced in section 21 of the activities regulations on competence. Extensive prescriptive competence requirements (with associated training curricula) are therefore contained in Norsok R-003, which have become normative for the industry through the regulatory reference. This has a cost-driving effect without it being possible to document a proportionate safety gain from these extensive competence requirements.<br><br>R-003 is not suitable as an international standard.<br><br>This assessment is based on both the current version and the existing draft for a new version. |

| **Conclusions Norsok R-005 Safe use of lifting and transport equipment in onshore petroleum plants** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision should be given priority.<br><br>Long-term perspective |
| **Cost/benefit** | Norsok R-005 contains extensive prescriptive competence requirements which have become normative for the industry by being referenced in the regulations. This has a cost-driving effect without it being possible to document a proportionate safety gain from these extensive competence requirements. |
| **Competitiveness** | |
| **Safety** | The standard has helped to raise the level of safety in the performance of lifting operations in petroleum activities on land. An operational standard like R-005 provides a safe and standardised way of conducting lifting operations in onshore facilities. |
| **Comments** | The background for recommending that Norsok R-005 should be given priority for revision is that a need exists for such a revision, where attention should be concentrated on enhancing efficiency and reducing costs. In addition, a need to simplify the standard and remove unnecessary details has been identified.<br><br>Norsok R-005 has contributed to a substantial raising of the safety level for lifting operations in petroleum activities in onshore facilities. Norsok R-005 contains a number of competence requirements and training curricula in appendix B. This appendix is referenced in section 62 of the technical and operational regulations on lifting operations. Extensive prescriptive competence requirements (with associated training curricula) are therefore contained in Norsok R-005, which have become normative for the industry through the regulatory reference. This has a cost-driving effect without it being possible to document a proportionate safety gain from these extensive competence requirements.<br><br>In principle, the Norwegian Labour Inspection Authority's regulations on the working environment cover the same areas as Norsok R-005. The government is urged to take an initiative on harmonising regulatory requirements for lifting operations on land. |

| Conclusions Norsok S-001 Technical safety | |
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| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision should be given priority.<br><br>Long-term perspective<br>All or part of the standard should be incorporated as improvements in an existing international standard. |
| **Cost/benefit** | Norsok S-001 could be a cost driver in relation to international practice. However, the requirements also represent cost-effective solutions which are needed to achieve Norway's high level of safety. A number of the specific cost-driving requirements in S-001 derive from former regulatory requirements. However, the standard offers good openings and space for optimisation and providing cost-effective solutions. Demands for LCI documentation in the industry to meet the requirements for safety systems are not entrenched in S-001, and the standard is thereby not a cost driver on this point. |
| **Competitiveness** | Knowledge of the requirements and methods in Norsok S-001 will be an advantage for players wishing to deliver to the NCS. |
| **Safety** | Norsok S-001 amplifies performance-based regulatory requirements so that these can be met and result in a good design from a safety perspective.<br><br>The requirements in S-001 help to produce a higher level of safety than is normally encountered internationally, but represents a level of robustness presupposed in the Norwegian regulations. |
| **Comments** | S-001 fleshes out the performance-based requirements and principles in ISO 13702. At present, the requirements in ISO 13702 are not specific enough to meet a Norwegian level of safety. Nor are any other standards available which could replace S-001.<br><br>Replacing S-001 with ISO 13702 will therefore undoubtedly be a lengthy process. However, the structure and content of S-001 should be suitable for internationalisation, although S-001 contains a number of special Norwegian requirements. Alternative solutions must be found for meeting these. |

| Conclusions Norsok S-002 Working environment | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision should be given priority.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | Use of the standard has largely replaced internal company requirements in the area. Nevertheless, a number of internal company requirements exist as supplementary, complementary or simplified requirements. A goal should be to formulate the standard in such a way that internal company requirements are rendered unnecessary.<br><br>The standard can increase costs for units working across continental shelf boundaries. |
| **Competitiveness** | Norsok S-002 has standardised the way the industry deals with the working environment in projects, in terms of overall principles (area design), specific design requirements (area requirements), methodology and documentation.<br><br>The standard has made a positive contribution to the Norwegian industry's competitiveness by standardising and improving the working environment on the NCS.<br><br>Norwegian players delivering to the NCS have had an advantage over foreign competitors with regard to knowledge of the standard, experience in applying it, and the necessary working environment expertise in the projects. |
| **Safety** | The standard has occupied and still occupies a key place in fulfilling the Working Environment Act's requirement for a fully acceptable working environment. |
| **Comments** | Following a review of the consultation draft for Norsok S-002 (in the second quarter of 2016), further work should be based on the following main guidelines.<br>• Norsok S-002 should be issued in a revised form as an ISO standard corresponding to ISO 35101. This should incorporate the essence of Norsok S-005.<br>• Norsok S-002 should be a design standard which could also be used in operations.<br>• The target group should be the project and not the working environment discipline (including acoustics and human factors). The standard should be applicable to all relevant project disciplines.<br>• The standard should be retained largely in its present form, but greatly simplified in relation to the consultation draft for a new S-002. Big changes to the design of the standard would mean the industry needs time to adapt and thereby carry a certain cost. |

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| | • The standard should be formulated in such a way that internal company design requirements for the working environment in the Norwegian petroleum sector are unnecessary.<br>• The standard should be formulated so that it can be used for both large and small projects, whether newbuild, modification or removal. Its application to vessels and unmanned facilities (standard of comfort) should also be described where relevant.<br>• The standard should build on experience-based design and make little provision for separate analysis. Specific requirements should largely be stated rather than derived from analysis in the project.<br>• The standard should be formulated with a level of precision which reduces the need for clarifications in the supplier chain to a minimum.<br>• The standard should be formulated in a way which is neutral in relation to regulations – in other words, all references to Norwegian regulations should be removed.<br>• Where the standard is not supported by good industry guidance or manuals, these should be developed rather than including extra guidance in the standard.<br>• The standard should have a separate chapter on machines which incorporates the essence of Norsok S-005 and designates the use of various machinery standards. |

| Conclusions Norsok S-003 Environmental care | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision should be given priority.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | The standard has been unchanged since 2005. To the extent that any new or amended requirements have emerged, these are the result of new/amended regulations.<br><br>Norsok S-003 recognises that conflicting objectives can affect the cost of a project. The standard provides guidance on how the operator can strike a good balance between these goals. By setting requirements for cost/benefit assessments, it can be regarded as a contribution to cost-efficient solutions.<br><br>Using Norsok S-003 can reduce duplicated work and inadequate evaluations in the impact assessment and in relation to meeting the requirements of the Norwegian Environment Agency. Using the standard will lead to more efficient project execution. |
| **Competitiveness** | Norsok S-003 contributes to competitiveness by highlighting requirements and guidelines from various regulations and organisations, and provides guidance on how these can be met. |
| **Safety** | Norsok S-003 has little relevance for the level of safety on the NCS. |
| **Comments** | Norsok S-003 could form the basis for an international standard about how concern for the natural environmental should be assessed in the various phases of a petroleum project.<br><br>Norsok S-003 is not suitable as an international standard about how concern for the natural environment should be assessed in connection with drilling and well operations.<br><br>Annex C on environmental requirements for drilling rigs should be reappraised in a future revision. |

| **Conclusions Norsok S-005 Machinery – working environment analyses and documentation** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Standard to be withdrawn.<br><br>Long-term perspective |
| **Cost/benefit** | |
| **Competitiveness** | |
| **Safety** | |
| **Comments** | Norsok S-005 is recommended for withdrawal and for incorporation in Norsok S-002 as an appendix.<br><br>Norsok S-002 should be issued in a revised form as an ISO standard corresponding to ISO 35101. The standard should incorporate the essence of Norsok S-005. |

| Conclusions Norsok S-006 HSE evaluation of contractors | |
|---|---|
| **Recommendation** | Short-term perspective<br>Standard to be withdrawn.<br><br>Long-term perspective |
| **Cost/benefit** | Some evaluation criteria in the standard go beyond the level normally considered "good enough" and beyond the HSE regulations.<br>The standard could be a cost-driver if it is implemented in operations outside Norway, since it largely reflects special Norwegian requirements. |
| **Competitiveness** | Using the evaluation model in Norsok S-006 to evaluate a company without operations in Norway against a Norwegian company for contracts to be executed outside Norway would favour the Norwegian company. This is because the model reflects Norwegian regulatory requirements, including special Norwegian working environment requirements. |
| **Safety** | Acceptable HSE requirements in contracts are a precondition for safety. However, the international IOGP 423 guidelines are considered to provide an equally good or better basis than Norsok S-006. |
| **Comments** | Norsok S-006 can be replaced by IOGP 423 *HSE management guidelines for working together in a working environment*.<br><br>A Norwegian national supplement may be required, in the form either of an IOGP appendix or of a simplified Norsok standard which refers to these guidelines. Such a supplement must reflect Norwegian regulations as well as normal work contracts/projects on the NCS in accordance with the "good enough" principle. When phasing out S-006, clear criteria must be ensured for classification of suppliers in Achilles. |

| **Conclusions Norsok S-011 Safety equipment data sheets** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Standard to be withdrawn.<br><br>Long-term perspective |
| **Cost/benefit** | |
| **Competitiveness** | |
| **Safety** | |
| **Comments** | Norsok S-011 provides examples of safety equipment data sheets. These are considered to be useful, and are recommended for retention as an appendix to Norsok S-001. |

| **Conclusions Norsok S-012 Health, safety and the environment (HSE) in construction-related activities** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Standard to be withdrawn.<br><br>Long-term perspective |
| **Cost/benefit** | The standard is cost-saving in that the companies have common requirements in such areas as safe job analysis (SJA) and supplier reporting. |
| **Competitiveness** | Norsok S-012 helps to streamline HSE work and reporting at suppliers. The standard does not contain unnecessary supplementary requirements which hinder competition. |
| **Safety** | Norsok S-012 contributes to an acceptable level of HSE in the supplies industry. |
| **Comments** | Norsok S-012 will be replaced by IOGP 423 *HSE management guidelines for working together in a working environment*.<br><br>Norsok S-012 *Health, safety and the environment (HSE) in construction-related activities* specifies common requirements which can enhance efficiency. However, large parts of the standard duplicate IOGP 423. A Norwegian national supplement may be required, in the form either of an IOGP appendix or of a simplified Norsok standard which refers to these guidelines. It is assumed that all relevant parts from S-012 are incorporated in IOGP 423. |

| Conclusions Norsok T-001 Telecom systems | |
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| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br>Should be merged with Norsok T-100.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | Norsok T-001 contributes to good technical and cost-effective solutions and emphasises the need to standardise telecommunication equipment and systems on a facility. That is important for both development and operation costs. |
| **Competitiveness** | Use of Norsok T-001 is well established and helps to give Norwegian suppliers and companies a competitive edge in operations on the NCS. |
| **Safety** | Norsok T-001 plays a key role in the design of communication systems. The standard ensures that systems related to emergency preparedness are designed in the same way across the NCS. It thereby helps to maintain an acceptable level of safety on Norwegian offshore facilities. |
| **Comments** | Norsok T-001 is well established in the Norwegian petroleum sector. It is used to some extent internationally, since no corresponding international standards exist.<br><br>Norsok T-001 could provide a good basis for developing an international standard for telecommunication system on offshore facilities.<br><br>Norsok T-001 and T-100 are closely related and have a similar level of quality, style and format. A natural approach is thereby to assess them jointly. The standards complement each other in a sensible way. Merging them into a single standard is recommended. |

| Conclusions Norsok T-003 Telecommunications and IT systems for drilling units | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective |
| **Cost/benefit** | Norsok T-003 was developed to standardise telecommunications and IT systems used on mobile drilling units to transfer data to the operator's own system and thereby avoid costs each time the unit is transferred to a new operator.<br><br>However, security requirements for communication and computer systems at each operator could require substantial replacement of equipment and systems. That limits the cost-saving opportunities offered by the standard. When the drilling rig is installed on a fixed facility, such as a wellhead platform, requirements for telecommunication equipment depend on the infrastructure already in place. This means that use of a standardised solution is not always possible. |
| **Competitiveness** | Use of Norsok T-003 should make it simpler to utilise mobile drilling units on the NCS, and thereby contribute to making drilling in these waters competitive. |
| **Safety** | Norsok T-003 helps to improve the level of safety on the NCS by facilitating the efficient transfer of information and data in connection with drilling operations, particularly in critical phases. |
| **Comments** | The standard is a mix of technical requirements, responsibilities for both installation and operation of systems, and guidelines on cost-sharing. It accordingly contains guidance on financial terms in the contract between operator and drilling contractor. These aspects should be regulated in the contract rather than the standard.<br><br>No international standards exist which could replace Norsok T-003, either wholly or in part. Standardisation in this area is considered difficult. In a longer perspective, withdrawal of the standard should be considered. |

| Conclusions Norsok T-100 Telecom subsystems | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br>Should be merged with Norsok T-001.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | Norsok T-100 contributes to good technical and cost-effective solutions and emphasises the need to standardise telecommunication equipment and systems on a facility. That is important for both development and operating costs. |
| **Competitiveness** | Use of Norsok T-100 is well established and helps to give Norwegian suppliers and companies a competitive edge in operations on the NCS. |
| **Safety** | Norsok T-100 plays a key role in the design of communication systems. The standard ensures that systems related to emergency preparedness are designed in the same way across the NCS. It thereby helps to maintain an acceptable level of safety on Norwegian offshore facilities. |
| **Comments** | Norsok T-100 is well established in the Norwegian petroleum sector. It is used to some extent internationally, since no corresponding international standards exist.<br><br>Norsok T-100 could provide a good basis for developing an international standard for telecommunication system on offshore facilities.<br><br>Norsok T-001 and T-100 are closely related and have a similar level of quality, style and format. A natural approach is thereby to assess them jointly. The standards complement each other in a sensible way. Merging them into a single standard is recommended. |

| Conclusions Norsok U-001 Subsea production systems | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision should be given priority.<br><br>Long-term perspective<br>All or part of the standard should be incorporated as improvements in an existing international standard. |
| **Cost/benefit** | U-001 is not considered to be a cost-driver in itself, but contributes almost without exception to cost reductions where water depth and fishing activity mean that subsea installations must be overtrawlable.<br><br>Some equipment manufacturers believe that U-001 provides a precise and accurate definition of relevant requirements for subsea facilities. Requirements, including well loads, are informative and thereby allow the use of project/field-specific specifications. That contributes to cost optimisation in the project.<br><br>Requirements for design loads in Annex A are specific to the NCS and generally set high standards for the design of wellheads, Xmas trees and seabed templates. That might boost costs (specifications for the use of the workover riser and LRP system, for example), but could be justified by increasing the operational window and operational robustness. |
| | The subsea sector has become more internationalised in recent years, with international owners and substantial parts of production outsourced to foreign subcontractors. Norsok U-001 contributes to increased standardisation for integrated template structure (ITS), wellhead and workover systems. Use of the standard is well established and helps to give Norwegian suppliers and companies a competitive edge in operations on the NCS.<br><br>Norsok U-001 is particularly relevant for technology used in areas often designated internationally as harsh environments. Knowledge of and experience with Norsok U-001 could be a competitive advantage for operators in areas where similar solutions can be utilised.<br><br>The suppliers industry could also have a competitive advantage internationally where overtrawlability is required. |
| **Safety** | Norsok U-001 contributes to a high level of safety by setting requirements for the design of overtrawlability and well loads. |
| **Comments** | ISO 13628 and the API 17 series overlap with Norsok U-001 to only a limited extent, but with U-001 providing additional regional requirements for overtrawlability and drilling loads.<br><br>Norsok U-001 accordingly covers requirements which are by and large particular for the NCS. This consideration must be taken into account when making internationalisation efforts. |

| **Conclusions Norsok U-009 Life extension for subsea systems** | |
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| **Recommendation** | Short-term perspective<br>Standard to be withdrawn.<br><br>Long-term perspective |
| **Cost/benefit** | |
| **Competitiveness** | |
| **Safety** | |
| **Comments** | Should it become clear after work on Norwegian Oil and Gas guideline 122 (GL 122) has been completed that all or part of the content in the standard must be retained, this will be done by establishing a separate Norwegian Oil and Gas guideline. |

| Conclusions Norsok U-100 Manned underwater operations | |
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| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective |
| **Cost/benefit** | Norsok U-100 describes best practice for conducting manned subsea operations on the NCS in accordance with applicable regulations.<br><br>The standard is already implemented in the industry and accordingly does not impose increased costs for those with existing operations on the NCS. New vessels are also built in accordance with U-100. |
| **Competitiveness** | The cost of implementing U-100 for manned underwater operations could make it difficult for new companies to become established in Norway or make it less attractive for operators to conduct such activities in petroleum operations on the NCS. On the other hand, providers of manned underwater operations who comply with U-100 will have an organisation and routines which are uncompetitive internationally without significant cuts, and this could pose a dilemma in terms of operating with double standards. |
| **Safety** | Norsok U-100 describes best practice for conducting manned subsea operations on the NCS in accordance with applicable regulations.<br><br>U-100 bridges regulatory and industry requirements and experience. Frequent revisions and active participation by the government, employers and unions have promoted continuous improvement.<br><br>U-100 has been developed in accordance with an Alarp mindset in accordance with Norwegian regulatory requirements. |
| **Comments** | The next revision of U-100 should focus on safety, costs, best practice and technological developments, in accordance with the intentions in Norsok. |

| Conclusions Norsok U-101 Diving respiratory equipment | |
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| **Recommendation** | Short-term perspective<br>Retained as Norsok**.**<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | Considerable overlap exists between test requirements in U-101 and the EN standards. Optimisation of the test programme for equipment should be pursued in order to avoid duplication and allow costs to be shared between the various standards. Internationalisation of U-101 could then ensure that relevant equipment is sold with the right quality, safety standard and price level, and even out cost differences between operations in certain sectors. |
| **Competitiveness** | Norsok U-101 must be regarded as special Norwegian requirements, which hinder competitiveness. |
| **Safety** | U-101 contributes to a higher level of safety. The standard contains realistic test parameters which are regarded as more stringent than international requirements. |
| **Comments** | The standard fills a gap which is not fully covered by existing international standards (CEN/ISO). Efforts should therefore be made to internationalise U-101 by using it as the basis for an international standard. |

| Conclusions Norsok U-102 Remotely operated vehicle services | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective |
| **Cost/benefit** | U-102 is robust, well-established and broadly supported by Norwegian operators and in the supplies market. This indicates that the standard is a good document which contributes to predictable costs.<br><br>The standard sets clear requirements for documentation, which can be perceived as boosting costs, but also as advantageous since no room for misunderstanding exists and an equal cost base is created for all the parties involved.<br><br>Compared with the Imca regime, U-102 can be regarded as a cost driver, since Imca is less specific and can give room for more of the user's own assessments than is the case with U-102. |
| **Competitiveness** | U-102 is directed towards the harsh offshore environment on the NCS in terms of wind, weather, waves and currents.<br><br>U-102 is a standard which potentially enhance the competitiveness of Norwegian suppliers (and foreign suppliers who conform to it) under certain circumstances. U-102 amplifies Imca's guidelines.<br><br>U-102 is well regarded and much used by Norwegian industry. It represents an important document for operators, contractors and ROV suppliers operating on the NCS. |
| **Safety** | U-102 specifies minimum requirements for safe and well-dimensioned technical solutions. It contributes to a good level of safety in the ROV sector.<br><br>The standard makes appropriate use of risk analyses, continuous improvement and the Alarp principle. |
| **Comments** | U-102 refers to other standards and guidelines for relevant adjacent disciplines, such as ISO/Norsok and Imca.<br><br>The standard contains technical requirements which fill an inadequately detailed gap in international standards. U-102 contains information required for operations on the NCS, which are not regarded at present as realistic for internationalisation.<br><br>U-102 is a well-established standard in active use, and has developed in step with the industry. |

| Conclusions Norsok U-103 Petroleum-related manned underwater operations inshore | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective |
| **Cost/benefit** | U-103 sets stricter requirements, which are cost driving, than the regulations for diving operations from the Norwegian Labour Inspection Authority. However, the standard represents a higher level of safety than is provided by the authority's guidelines.<br><br>Many of the cost-driving factors relate to requirements for equipment, organisation and personnel. |
| **Competitiveness** | |
| **Safety** | U-103 provides a level of safety which is regarded as more stringent than is provided by the Norwegian Labour Inspection Authority's regulations. |
| **Comments** | The government is urged to take an initiative to harmonise regulatory requirements for diving operations along the Norwegian coast. |

| **Conclusions Norsok Y-002 Life extension for transportation systems** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Standard to be withdrawn.<br><br>Long-term perspective |
| **Cost/benefit** | |
| **Competitiveness** | |
| **Safety** | |
| **Comments** | Should it become clear after work on Norwegian Oil and Gas guideline 122 (GL 122) has been completed that all or part of the content in the standard must be retained, this will be done by establishing a separate Norwegian Oil and Gas guideline. |

| Conclusions Norsok Z-001 Documentation for operation (DFO) | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision must be a priority.<br><br>Long-term perspective<br>Should be given priority for internationalisation, but must be revitalised under the auspices of Norsok before this can be accomplished. |
| **Cost/benefit** | Substantial cost cuts can be achieved by eliminating company-specific requirements in favour of using revitalised Norsok Z standards.<br><br>Revitalising the Z standards so that the operator companies extensively reduce their own specific requirements to a minimum would provide a substantial potential for cutting costs and enhancing quality in the industry with regard to the development and management of technical information. |
| **Competitiveness** | Using revitalised Norsok Z standards will make the Norwegian petroleum industry more cost-effective and competitive. |
| **Safety** | Developing the Z standards in a prescriptive direction and taking account of technological progress could have a positive effect on the level of safety. That applies particularly to safety-critical and certifying documentation. |
| **Comments** | Before a revision of the Z standards is initiated, a detailed mandate for the work must be drawn up which clarifies its direction. A precondition for starting this extensive revision job is that operator companies in Norway commit to allocating resources to lead and act as the prime movers for the revision project. The Z standards are regarded as an important area for cost reductions and enhanced efficiency, and a high priority should be given to the work.<br><br>Since very few international standards exist in the area covered by the Z standards, revitalised standards have the potential to be proposed as international standards. |

| **Conclusions Norsok Z-003 Technical information flow requirements** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision must be a priority.<br><br>Long-term perspective<br>All or part of the standard should be incorporated as improvements in an existing international standard. To accomplish this, however, it must first be revitalised under the auspices of Norsok. |
| **Cost/benefit** | Substantial cost cuts can be achieved by eliminating company-specific requirements in favour of using revitalised Norsok Z standards.<br><br>Revitalising the Z standards so that the operator companies extensively reduce their own specific requirements to a minimum would provide a substantial potential for cutting costs and enhancing quality in the industry with regard to the development and management of technical information. |
| **Competitiveness** | Using revitalised Norsok Z standards will make the Norwegian petroleum industry more cost-effective and competitive. |
| **Safety** | Developing the Z standards in a prescriptive direction and taking account of technological progress could have a positive effect on the level of safety. That applies particularly to safety-critical and certifying documentation. |
| **Comments** | Before a revision of the Z standards is initiated, a detailed mandate for the work must be drawn up which clarifies its direction.<br><br>As part of a revision, the use of ISO 15926 *Integration of life-cycle data for process plants including oil and gas production facilities* and ISO 81346 *Structuring principles and reference designations* must be assessed in order to permit standardised interaction. Specification of named applications and/or application portfolios is not acceptable. The integration strategy must be performance-based and ensure good interoperability. |

| Conclusions Norsok Z-004 CAD symbol libraries | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision must be a priority.<br><br>Long-term perspective |
| **Cost/benefit** | Substantial cost cuts can be achieved by eliminating company-specific requirements in favour of using revitalised Norsok Z standards.<br><br>Revitalising the Z standards so that the operator companies extensively reduce their own specific requirements to a minimum would provide a substantial potential for cutting costs and enhancing quality in the industry with regard to the development and management of technical information. |
| **Competitiveness** | Using revitalised Norsok Z standards will make the Norwegian petroleum industry more cost-effective and competitive. |
| **Safety** | Developing the Z standards in a prescriptive direction and taking account of technological progress could have a positive effect on the level of safety. That applies particularly to safety-critical and certifying documentation. |
| **Comments** | Before a revision of the Z standards is initiated, a detailed mandate for the work must be drawn up which clarifies its direction.<br><br>Further internal development of the symbol libraries in the companies must form the basis for the update. |

| Conclusions Norsok Z-005, 2D-CAD drawing standard | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision must be given priority.<br><br>Long-term perspective |
| **Cost/benefit** | Substantial cost cuts can be achieved by eliminating company-specific requirements in favour of using revitalised Norsok Z standards.<br><br>Revitalising the Z standards so that the operator companies extensively reduce their own specific requirements to a minimum would provide a substantial potential for cutting costs and enhancing quality in the industry with regard to the development and management of technical information. |
| **Competitiveness** | Using revitalised Norsok Z standards will make the Norwegian petroleum industry more cost-effective and competitive. |
| **Safety** | Developing the Z standards in a prescriptive direction and taking account of technological progress could have a positive effect on the level of safety. That applies particularly to safety-critical and certifying documentation. |
| **Comments** | Before a revision of the Z standards is initiated, a detailed mandate for the work must be drawn up which clarifies its direction.<br><br>The standard should be simplified, since experience shows that ambitions related to the level of detailing have been excessive. |

| Conclusions Norsok Z-DP-002 Coding system | |
|---|---|
| **Recommendation** | Short-term perspective<br>Standard to be withdrawn.<br><br>Long-term perspective |
| **Cost/benefit** | |
| **Competitiveness** | |
| **Safety** | |
| **Comments** | The standard is not in use.<br><br>Engineering costs for standard equipment packages can be substantially reduced if the operator companies can handle supplier code standards in their LCI applications.<br><br>Sales and purchase of facilities enhance the relevance of managing different coding systems.<br><br>On the basis of the above, an feasibility study is recommended on handling the various code standards in an effective manner. |

| **Conclusions Norsok Z-CR-002 Component identification system** | |
|---|---|
| **Recommendation** | Short-term perspective<br>Standard to be withdrawn.<br><br>Long-term perspective |
| **Cost/benefit** | |
| **Competitiveness** | |
| **Safety** | |
| **Comments** | Z-CR-002 has played a key role in the establishment of ISO 15926 *Integration of life-cycle data for process plants including oil and gas production facilitie*s. Since the standard's functions are covered by ISO 15926, withdrawal of Z-CR-002 is recommended. |

| Conclusions Norsok Z-006 Preservation | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | No alternative standards are available in this area. A common standard is cost-efficient compared with developing company-specific requirements. The standard contributes to good technical and cost-effective solutions on the NCS. |
| **Competitiveness** | The standard describes principles and practical methods for effective preservation of systems and equipment. That contributes to more predictable project execution and a higher probability of avoiding delays and shutdowns because of system degradation. |
| **Safety** | Norsok Z-006 describes a systematic approach to planning and executing preservation. This will result in fewer undesirable incidents in both kick-off and the early phase, and thereby contribute to a higher level of safety. |
| **Comments** | No international alternatives are available for these standards because this type of standard is primarily company-specific on a global basis. That could create challenges for internationalisation. |

| Conclusions Norsok Z-007 Mechanical completion and commissioning | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | No alternative standards exist for this area. A common standard is cost-effective compared with developing company-specific requirements. The standard contributes to good technical and cost-effective solutions on the NCS.<br><br>The standard is regarded as robust for systematic execution of mechanical completion and commissioning. It is useful for planning and executing activities and thereby contributes to cost-efficiency. |
| **Competitiveness** | Norsok Z-007 describes principles and practical methods for undertaking secure and efficient completion of new facilities and major modifications. That contributes to more predictable project execution. |
| **Safety** | Norsok Z-007 describes a systematic approach to planning and executing the completion of new facilities and major modifications. That will lead to fewer incidents during start-up and production in the early phase, and thereby help to achieve an acceptable level of safety. |
| **Comments** | No international alternatives are available for these standards because this type of standard is primarily company-specific on a global basis. That could create challenges for internationalisation. |

| Conclusions Norsok Z-008 Risk-based maintenance and consequence classification | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision should be given priority.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | No standards for consequence classification exist other than Norsok Z-008. A common standard is cost-effective compared with developing company-specific requirements.. |
| **Competitiveness** | The HSE regulations specify special Norwegian requirements for maintenance management and consequence classification. If rig contractors wish to operate on the NCS, they must convert their maintenance system in order to satisfy the special Norwegian requirements on consequence classification in the HSE regulations. |
| **Safety** | Good maintenance is a precondition for safe operation of the facilities. |
| **Comments** | The evaluation has identified that the standard is imprecise in certain areas. It should therefore be given priority for revision, not least because the HSE regulations refer to standards other than Z-008 for maintenance programmes. However, that could easily be misunderstood to mean regulation in this area is duplicated. To avoid giving the impression that the regulations refer to the whole of Z-008, chapter 8 on maintenance programmes should be deleted as a normative requirement. |

| Conclusions Norsok Z-013 Risk and emergency preparedness assessment | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision should be given priority.<br><br>Long-term perspective<br>Should be given priority for internationalisation. |
| **Cost/benefit** | Z-013 is not considered a cost driver in itself. On the other hand, industry practice on the use and conduct of analyses could be a cost driver. This underlines the need to ensure that a revised version of the standard provides a clearer description of the practice which is desired. |
| **Competitiveness** | Z-013 is a good standard, which describes how risk analyses should be implemented in order to clarify a quantitative risk picture.<br><br>Although a number of international standards exist in this discipline, none cover the whole scope of Norsok Z-013. |
| **Safety** | Z-013 contains good methodological descriptions for analysing main safety functions. This represents necessary associations with Norwegian regulations and should be retained in Z-013.<br><br>Z-013 supports the establishment and use of dimensioning accident loads and should be retained. Should the industry want to take alternative approaches to the design basis, these methodologies should be reflected in Z-013.<br><br>The emergency preparedness part of Z-013 is of limited value and could advantageously be replaced with or linked more strongly to ISO 15544.<br><br>Z-013 should be strengthened with regard to risk/safety management and in relation to the analysis and management of barriers. To achieve this, the standard should be linked more strongly to ISO 17776. |
| **Comments** | The standard should be revised to adapt to international standards and new regulations (particularly section 11 of the framework regulations with guidelines), and to clarify which practice it wishes to support. |

| Conclusions Norsok Z-014 Standard cost coding system (SCCS) | |
|---|---|
| **Recommendation** | Short-term perspective<br>Standard to be withdrawn.<br><br>Long-term perspective |
| **Cost/benefit** | |
| **Competitiveness** | |
| **Safety** | |
| **Comments** | The standard is already on its way to ISO 19008. |

| Conclusions Norsok Z-015 Temporary equipment | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision should be given priority.<br><br>Long-term perspective<br>Internationalisation should be sought. |
| **Cost/benefit** | The background for establishing Norsok Z-015 was that the oil companies had their own specifications for temporary equipment. These varied, making it difficult for suppliers to meet the requirements. The introduction of Z-015 led to an enhancement in quality and efficiency, which thereby laid the basis for cost reductions.<br><br>However, it is claimed that the detailed requirements in Z-015 result in a number of unnecessary costs for the industry on the NCS. This relates to certain requirements which complicate direct transfer of international temporary equipment to Norwegian facilities. |
| **Competitiveness** | To the extent that Z-015 exceeds international industry practice, the standard affects competition in the market. Good knowledge of Z-015 provides a competitive advantage in Norway. |
| **Safety** | Z-015 contributes to an acceptable level of safety for temporary equipment on the NCS. |
| **Comments** | The standard is suitable for internationalisation, but will then require a reduction in the references to Norwegian regulations. |

| Conclusions Norsok Z-018 Supplier's documentation of equipment | |
|---|---|
| **Recommendation** | Short-term perspective<br>Retained as Norsok – revision given priority.<br><br>Long-term perspective<br>Should be given priority for internationalisation. To accomplish this, however, it must first be revitalised under the auspices of Norsok. |
| **Cost/benefit** | Substantial cost cuts can be achieved by eliminating company-specific requirements in favour of using revitalised Norsok Z standards.<br><br>Revitalising the Z standards so that the operator companies extensively reduce their own specific requirements to a minimum would provide a substantial potential for cutting costs and enhancing quality in the industry with regard to the development and management of technical information. |
| **Competitiveness** | Using revitalised Norsok Z standards will make the Norwegian petroleum industry more cost-effective and competitive. |
| **Safety** | Developing the Z standards in a prescriptive direction and taking account of technological progress could have a positive effect on the level of safety. That applies particularly to safety-critical and certifying documentation. |
| **Comments** | Before a revision of the Z standards is initiated, a detailed mandate for the work must be drawn up which clarifies its direction. A precondition for starting this extensive revision job is that operator companies in Norway commit to allocating resources to lead and to act as the prime movers for the revision project. The Z standards are regarded as an important area for cost reductions and enhanced efficiency, and a high priority should be given to the work.<br><br>Since very few international standards exist in the area covered by the Z standards, revitalised standards have the potential to be proposed as international standards. |

## APPENDIX B – REFLECTIONS ON PETROLEUM STANDARDISATION

During the life of the project, the project secretariat has become aware of aspects of petroleum standardisation which could be described as reflections, thoughts and/or observations on the subject. These aspects help to provide an even better understanding of what petroleum standardisation involves.

The management group asked the project secretariat to describe and include these reflections/thoughts on petroleum standardisation in the project report. They are presented in this appendix, which therefore represents an addition to the original project mandate.

It must be emphasised that these reflections are not to be understood as the views or positions of the Norsok owners. They must be read as subjective views and/or experience which various stakeholders in petroleum standardisation have conveyed or expressed.

Summaries are also presented from other parallel assignments or projects which have, or could have, relevance for this project, for petroleum standardisation in general, or for related subjects.

### B.1 Reflections on a performance-based HSE regulatory regime

In everyday parlance, the terms "performance-based" and "functional"/"functionally-based" are used to describe Norway's HSE regulations for the petroleum sector. However, "functional" can also mean that the regulations are appropriate and adapted. The term "performance-based" is accordingly used below to describe the regulations.

The performance-based requirements specify the various functions, properties or qualities to be possessed by a product, process or service. The requirement expresses what result the product, process or service should produce. In other words, a performance-based requirement is an expression of what the regulator wants to achieve with it, and the function and context it should be used in.

When the operators specify performance-based system requirements, a supplier can define its own solution or service on the basis of these. The supplier's experience and creativity will find expression in its standard system solutions. Since the supplier will meet the same performance-based requirements from project to project, it will be in a better position to deliver standard products. That can provide substantial savings on system deliveries and the project as a whole.

#### *B.1.1 Performance-based regulations = a strict Norwegian regulatory regime?*

The Norwegian HSE regulations are formulated as performance-based requirements which specify the properties and quality which the equipment must possess. How the equipment is designed to fulfil a regulatory requirement is up to the individual player. This regulatory technique means that the players themselves must flesh out the provisions in the regulations by drawing up specific requirements for methods and procedures which meet the required result. See section 24, paragraph one of the framework regulations.

This freedom of choice is a special feature of the Norwegian regulations, and builds on the assumption that the players themselves possess the relevant expertise and are best equipped to decide which approach gives the best result. The regulations facilitate the adoption of flexible and efficient solutions. This approach also avoids the regulations becoming quickly out-of-date and hindering the implementation of technological advances, which is the case with regulatory provisions which contain detailed descriptions of mandatory approaches.

While performance-based regulations provide freedom, they also require the players to interpret and amplify their provisions. The solution to be chosen will depend on deciphering the level of safety sought in the regulatory requirements, which are often expressed in general terms. A judgement must be made about the quality of the various options, the risks associated with them in relation to their intended use, and general cost/benefit aspects. This is a demanding exercise, and doubts can easily arise about how far a contemplated solution fulfils the relevant regulatory requirements. A high level of trust between the regulator and the industry is therefore important.

The regulations are supplemented by guidelines which provide more detailed descriptions of how the requirements are to be understood, and references to selected standards as a recommended way of complying with the relevant requirement. These guidelines are meant to give the players some reassurance that their understanding of the regulatory requirements is correct. They are also intended to ensure that the players seek a level of safety which is more or less similar and adequate.

However, neither the guidelines nor the standards they refer to are legally binding. The players are free to choose solutions other than those indicated in the guidelines. This follows from the systematic basis of the regulations and is assumed in section 24 of the framework regulations. This provision requires that players who use solutions other than those recommended in the guidelines are able to document that their chosen option complies with the regulatory requirements. This is "only" a procedural rule. In material terms, another solution can be chosen as long as the player can establish that it satisfies the regulatory requirements.

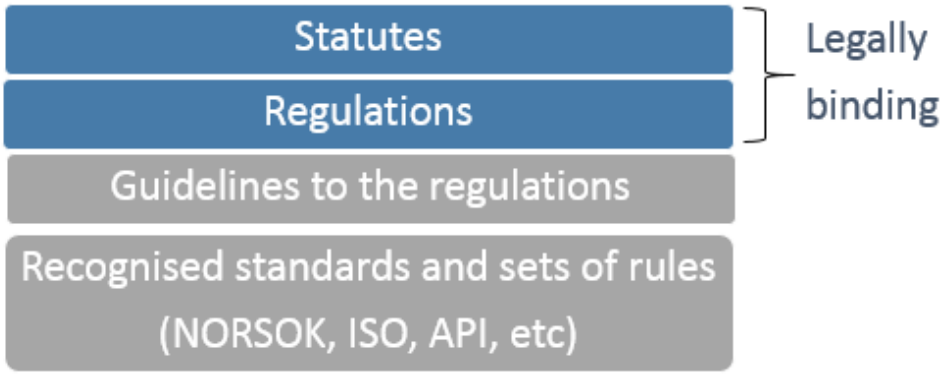


Figure 10 – Relationship between statutes, regulations, guidelines and recognised standards/norms. (Source: Menon report (23))

The standards referenced in the Norwegian HSE regulations are not exclusively Norwegian in origin. On the contrary, reference is made to a number of international standards and sets of rules as yardsticks for the required level of safety, including API, ISO, DNV GL, IEC, IMO, Imca and EN. Nor are the requirements in the Norwegian standards stricter than in others. Using an international standard may well impose tougher requirements for safety and involve higher costs than Norsok or other Norwegian standards or rules.

*B.1.2 Are the performance-based regulations used incorrectly?*

HSE requirements on the NCS have remained by and large unchanged over the past 15 years. A perception nevertheless prevails in the industry that requirements for equipment have become stricter and more numerous in the past decade. According to ***Menon publication***

***39/2016 – Requirements as cost drivers on the NCS*** (23), however, it has not been possible to verify this. On that basis, it is assumed that this perception primarily reflects the way players apply the regulations rather than their material content.
Some observations suggest that many people interpret and apply the guidelines with their recommended standards as if they were legally binding – which is not actually the case. An example, taken from the Menon report, is a case where the customer specified special requirements for clearance and reach of a crane pursuant to Norsok S-002. This standard is a recommended norm for complying with the requirements for ergonomic design in the guidelines to section 20 of the facilities regulations. The challenge for the supplier was that the crane could not be adapted in an appropriate way to other equipment on the drill floor without coming into conflict with the requirement in Norsok S-002 for 1 800 millimetres as the maximum steering height for units used once a month or more. After a number of discussions between the customer and the equipment supplier, it was decided to design the crane in accordance with the maximum height requirement in Norsok S-002 by reducing its robustness. Representatives for the equipment supplier regarded the solution as "inappropriate" for the lifts the crane was to handle. This example illustrates how inadequate knowledge of the regulations can lead to unnecessary costs with inappropriate solutions, which can in the worst case represent a safety risk or threaten safety.

Inadequate knowledge about interactions in the regulations could be connected to the fact that issues related to requirements are in many cases formulated and dealt with by technical personnel. Even with a general awareness of the systematic approach taken by the regulations, dealing with their requirements can pose challenges in practice. The standards referenced in the guidelines as recommended norms are fairly detailed in their form. Breaking free from a detailed formulation in the standard, while using this as a yardstick when interpreting regulatory requirements, can be a demanding exercise.

### *B.1.3 Do performance-based regulatory requirements hinder technology development and innovation?*

When uncertainty prevails over regulatory requirements, the most conservative interpretation is often chosen. This could be because the buyer and the turnkey supplier are unwilling to risk being held responsible for possible errors. Individuals also feel great responsibility for choosing a solution which accords with the regulations, and accordingly lack incentives to argue for a solution other than the one recommended in the guidelines. Many players opt to fall back on the solution they have used before, even when a new and more efficient option has been developed.

Treating the guidelines as legally binding is a problem because it totally "throttles" scope for alternative action. This practice is contrary to the assumption – on which the regulations build – that the players decide which solutions are most suitable in each case on the basis of a qualified assessment of risk and cost-benefit. The practical result is that the solutions chosen are more expensive than required or necessary from a safety perspective, and that the potential offered by available technical solutions is not exploited.

An important point in this context is that using a recommended standard does not free the players from their duty to make an independent assessment of the chosen solution. The players have not only a right but also a duty to choose another solution than the ones recommended in a guideline if this yields a better result. After all, the performance-based regulations build precisely on the view that responsibility for choosing a solution should rest with the industry. Using a recommended solution therefore provides no guarantee that it meets the legally binding regulatory requirements.

Should a long time have passed since a standard was updated and new and better equipment has subsequently been developed, the regulatory requirements for a solution would be

stricter than those required by the (outdated) standard. This is because the players are obliged to boost safety in line with technological progress, in accordance with the principle of continuous improvement and the use of best available technology (BAT).

*B.1.4 Performance-based versus prescriptive requirements*

The alternative to performance-based regulations is a regime based on prescription, characterised by detailed regulatory requirements. Such requirements require frequent updating as technology advances. Drawbacks with this type of regulation are that the prescriptive provisions can easily become very extensive, that unregulated areas will always exist, and that the regulations can slow innovation and technical development. US petroleum legislation is an example of national regulation with a larger proportion of prescriptive HSE requirements than in Norway. However, it is important to emphasise that prescriptive provisions can be more appropriate in certain areas. In particular, prescriptive requirements have proved necessary in the regulations on working time arrangements, for example.

## B.2 Reflections, myths, facts and comments related to Norsok standards

During the project period, the project secretariat has been confronted on a number of occasions with statements like:

- "the Norsok standards are major cost drivers"
- "using Norsok standards in projects adds to costs".

When assessing the Norsok standards during the Norsok analysis project and through conversations with various stakeholders in the petroleum industry, the project secretariat has looked for various views on and examples of the use of these standards. The project secretariat presents these reflections below, but would emphasise that they are reproduced verbatim. It is up to the reader to assess and form an opinion on these statements.

*B.2.1 Norsok as a source of arbitration issues*

"Challenges with the performance-based requirements in the Norsok standards have arisen and arise particularly over the design and fabrication of topsides. These problems relate primarily to contracts where the supplier has undertaken to deliver a topsides under an EPC contract."

"A recurring problem in practice is that the performance-based requirements can be difficult to understand, particularly for foreign suppliers without previous experience of Norsok. This is despite the fact that the contracts have generally made it clear that the topsides are to be designed and built in accordance with the requirements in Norsok, and despite the fact that the oil companies have tried to ensure that suppliers have had adequate Norsok expertise – through training and 'leasing' of personnel."

"Examples of Norsok provisions which have proved difficult to understand are the requirements for fire-extinguishing equipment (number of pumps, etc), explosion loads and living quarters (size and standard)."

"Because some Norsok requirements have proved difficult to understand, they have been misunderstood – which has led to design and fabrication work being initiated on an insufficiently matured basis. This has meant in turn that the job has had to be done again, which has resulted in additional costs, loss of productivity and delays. It has also resulted in weight problems, which have complicated installation and hook-up. Design errors and corrective work as a consequence of inaccurate and/or disputed understanding of Norsok requirements can undoubtedly explain a number of cost overruns and delays."

"Because Norsok requirements, like other performance-based descriptions, can open several routes to the objective, many and extensive discussions have taken place between suppliers and the oil companies about how strictly the requirements should be understood. Unlike the above-mentioned cases with design errors, genuine uncertainty can arise here on whether the supplier's proposed solutions meet the minimum requirements. Since the oil companies seldom want to take the risk that such minimum solutions could be rejected by the PSA, which could lead to corrective work and delays, they generally prefer more 'robust' interpretations of Norsok. For their part, the suppliers generally regard such 'robust' interpretations as exceeding the minimum requirements – hence the term 'goldplating'. Accusations of goldplating occur particularly often in lump-sum contracts, where the supplier naturally has a strong incentive to opt for the 'cheapest' solutions."

"The PSA supervises the projects, in part to ensure compliance with the Norsok requirements. Since such supervision concentrates on work already done, however, the PSA generally provides guidance only when it is 'too late' – when the error has occurred. A number of suppliers have tried to establish direct contact with the PSA to obtain 'advance comments' on what minimum requirements can be derived from Norsok, but our impression is that the PSA will deal only with the oil company (the operator who has the main responsibility for following up the 'see to it' duty). This has created great frustration at some suppliers."

*B.2.2 "Field" injection project*

"In the conceptual phase, suppliers were asked to estimate the time and cost of delivering systems and equipment in accordance with Norsok. As part of the value improvement process (VIP) for the project, the possibility was assessed of reducing project costs by using performance-based requirements pursuant to the regulations (performance-based regulations) and standards the suppliers were familiar with. This led to a substantial reduction in cost estimates (around 20 per cent). That looked good until somebody checked why Norsok added so much to costs. One response from the suppliers was that they were unfamiliar with Norsok's detailed requirements, and therefore had to add a mark-up to guard against cost overruns. In this case, therefore, it was ignorance about the Norsok standards which led to the cost rise."

*B.2.3 Drilling and production N-class jack-up rigs*

"The management of one company stated that N-class rigs cost about 25 per cent more than other jack-ups. This was primarily attributed to working environment requirements in Norsok. Some uncertainty prevails about how much of this cost mark-up related to automated pipe handling. The rigs were specially designed for the NCS and built at the Keppel Fels yard in Singapore. This was the first Norwegian project Keppel was responsible for since Balder, and it was rather cautious ('to be on the safe side') with regard to the application of Norwegian requirements."

*B.2.4 Norsok in relation to design and modification*

"Working environment requirements in Norsok (such as S-002 *Working environment*, C-001 *Living quarters area* and C-002 *Architectural components and equipment*) are less of a cost driver if they are taken into account at the conceptual design phase of a project."

"Although each additional requirement, viewed in isolation, adds moderate supplementary costs, it is important to look at the overall cost consequences. Consequential costs can arise, for example, because of weight effects and restrictions. The relationship between weight and cost increases does not need to be linear. The theory of 'the straw that breaks the camel's back' applies. If the loadbearing capacity of a facility is exceeded, the conceptual solutions may in the worst case have to be changed, with substantial consequences."

"If Norsok requirements are applied to a facility designed in line with other assumptions – maritime standards, for example – the cost consequences can be even greater. That will apply to drilling rigs designed for international operation. Simple requirements for access techniques or living quarters can lead in the ultimate analysis to very extensive modifications. Space and weight restrictions mean that area requirements have much greater consequences on a cramped offshore facility than with activities on land, where space is not a constraint. Offshore installation work is also much more expensive than on land. Caution must therefore be displayed when setting requirements for extra space offshore which has no significance for major accident risk."

*B.2.5 Norsok as a cost driver?*

"The most important factor in a project does not appear to be whether Norsok is being used. It is a good understanding of the Norsok standard(s) when designing the project. Regardless of the standards used (international, other industry and so forth), knowledge of them is required to succeed with a good, cost-effective project. The project's main impression from using Norsok standards is that they provide a good basis for building a safe and efficient facility, and Norsok standards will not necessarily lead to cost differences compared with using other standards."

"It must also be mentioned that Norway's ambition to be a world leader for safety will call for high standards in designing and operating facilities on the NCS. Standardisation which lead to compromises and which level out safety standards are unlikely to make the country the world leader for the level of safety."

*B.2.6 Norsok versus company-specific requirements*

"To a great extent, it is the scope of documentation requirements and the number of company-specific requirements and references which have contributed to increased costs in Norway's petroleum sector over the past decade. A number of the Norsok standards have not been updated during the period, when costs in the industry have in places increased many times over. So the requirements in the Norsok standards have not changed over the time when we have observed the cost rises. The latter therefore cannot be attributed to the Norsok standards in these cases, but rather to the scope of added documentation requirements and company specifications."

*B.2.7 Is it expensive to use standards?*

"Developing standards can seem expensive in the short term, but using common standards will reduce the need for tailored solutions in the long run. Without standards, more damage and accidents can occur. The consequences can be substantial and costly. So it is essential to set strict standards for equipment loads. Using the same standard makes it easier for the oil companies to change supplier and products because solutions and services become more standardised and global."

*B.2.8 Views from a subsea supplier operating in a global market*

"While some Norsok requirements are implemented in our standards internationally, direct references to Norsok mainly occur with projects on the NCS. But I would make special mention of materials, where Norsok specifications are used globally. That applies particularly to duplex and superduplex, plus structural steel. A number of Norsok specifications also form the basis for later ISO issues, and that is naturally an advantage for Norwegian industry which has generally already incorporated the Norsok requirements."

"We have also seen many examples of companies accepting Norsok in place of their own specifications for equipment produced in Norway, since they know these requirements are well established in production and fully acceptable. That is the case even if Norsok is not referenced in the contract."

"I also have some reflections on the significance of the Norsok standards for competitiveness. Norsok is often accepted for equipment delivered from Norway as a replacement for company-specific requirements, which boosts our competitiveness. The subsea sector is perhaps a little special, since we seek to supply components and equipment in accordance with the same requirements regardless of where they go worldwide. We organise ourselves through product delivery teams and product groups in order to be efficient and competitive, which makes it important to have standard requirements for the equipment and its production. Using Norsok as our basis means we are very sure our standard will be accepted by most operators, including internationally. I don't know whether Norsok is directly significant for our competitiveness, since all our competitors are well established in Norway, participate in developing the Norsok standards and are very familiar with them. Or do the standards contribute to innovation and technology development? Some examples indicate this – such as the reactive flex joint for reducing loads on the wellhead during drilling and completion."

"Finally, a few words about the significance of the standards for capex and opex. Standard requirements are important for being able to industrialise the subsea sector, which will in turn reduce capex without affecting the quality or performance of the equipment. Furthermore, we can say that increased quality (quality of the standards) in the construction phase can reduce the need for later upgrading. Developing standards can seem expensive in the short term, but using common standards will reduce the need for tailored solutions in the long run. Without standards, more damage and accidents can occur. The consequences can be substantial and costly. So it is essential to set strict standards for equipment loads. Using the same standard makes it easier for the oil companies to change supplier and products because solutions and services become more standardised and global."

### *B.2.8 Examples of the use of standards by a major international supplier*

"I have listed two examples below of the anticipated use of standards in two offshore wind power projects which have yet to kick off."

"Example project 1:

The hierarchy of codes is as follows.

1. DNV-OS-J201 *Offshore substations for wind farms*.
2. DNV-GL.
3. Noble Denton guidelines.
4. Norsok guidelines.
5. European standards (EN), international ISO and IEC standards, NFPA for firefighting."

"Example project 2:

The general hierarchy of codes and standards is as follows.

1. German regulations and TOG project specifications.
2. DIN standards, European standards (EN), ISO and IEC standards.
3. International codes – including DNV GL codes and international conventions for aviation and marine safety and pollution at sea. DNV GL-ST-0145 is to be considered the leading code in this respect.
4. Norsok standards.
5. American offshore codes."

*B.2.9 FPSO – experience of a shipowner who has specialised in such vessels*

The memo provides a brief summary of one shipping company's use of Norsok standards:

"This reflects standards we prefer to use with new FPSOs. Customer (oil company) and government requirements in the country where the FPSO is to work primarily determine our choice of standards. We otherwise select from well-known international standards, where Norsok standards represent one category."

"For piping & layout
- 4119-BWO-L-SA-00005 *Piping & valve material spec topsides*: Norsok L-001, L-002, L-004, L-005, M-630, R-004
- 4119-BWO-L-SA-00008 Piping detail standard: Norsok L-CR-0003; L-CR-001"

"For technical safety:
- Norsok S-002/C-002 *Working environment* (guidance) and material handling.
- Norsok P-001 for sizing of open drain lines.
- Norsok M-501 for PFP (surface preparation)"

"For process:
- We reference Norsok P-002 *Process system design* in our process design philosophy (4119-BWO-P-FD-00001)."

"No other disciplines have confirmed use or reference to Norsok."

"We have also based some of our work on parts of the Norsok standards for the HVAC, material selection and instrument/telecom disciplines, and our technical coding is also very similar to Norsok."

*B.2.10 Interest by nuclear power plants in using Norsok standards*

"Brief background: I participated a few years ago in a project team in Sweden looking at the 'safety culture' in the Swedish nuclear power sector. The background was a need for/interest in a better overview of the safety culture at contractors (service providers) who enter and work at the nuclear power stations during turnarounds. I was contacted by Oskarshamn Kärnkraftgrupp (OKG), and opportunities were seen for doing more in this area – ensuring better understanding of suppliers' safety culture. OKG contacted Achilles and me to seek to facilitate experience transfer from the Norwegian oil and gas sector, which has come a long way in this area, of course. We started by contacting Statoil, which shared its experience and processes, and on that basis produced an outline concept for the Swedish nuclear power sector. We visited all three nuclear facilities for soundings, and interest was good both in the model/concept and in specific questions/checklists (Norsok). Feedback was clear that this was interesting, and much of what was used on the Norwegian side (Norsok) should be applicable here with small adjustments. We visited HSE/QA at Ringhals, Forsmark and OKG."

"I took a step away from this project because of other commitments in Achilles, and the contact in OKG also moved abroad, and I believe unfortunately that this was not implemented in operational routines."

"Interest was also expressed in organising a meeting to exchange experience and share best practice (and look at the use of standards) in this area, and I believe this could actually still be interesting."

## B.3 DNV GL standards versus Norsok standards

DNV GL has been asked to describe how it complements, supplements and/or overlaps with Norsok and maritime standards. Its explanation is reproduced in this section:

*General*
"DNV GL provides services in certification, verification and technology qualification for the oil and gas industry. The basis for these services is statutes, regulations, recognised standards (including Norsok) and our own standards and guidelines (recommended practices – RPs). By and large, we will issue publications which complement and amplify the Norsok standards, even if standards overlapping with Norsok exist in a few cases. In the same way as with ISO, CEN and API, we contribute actively to Norsok standardisation by participating in Standards Norway's expert groups. We also work on assignments to prepare and revise Norsok standards. We see no opposition between developing our own standards and contributing to good external standards. A number of examples also show that early-phase standardisation documents from us have been used as a basis for later industry standardisation."

*Supplements*
"Most of our standards and guidelines in the oil and gas area are developed to meet identified unmet requirements for standardisation/guidelines. Typically, these could be standardisation of new technology or supplementing/detailing performance-based requirements in external standards. Development is often pursued through joint industry projects (JIPs)."

"This type of DNV GL document supplements the Norsok standards. One example is Norsok's N-004 structural standard, which references our RPs in such special areas as analysis of fatigue and buckling."

*Complements*
"In some cases, we have been specifically asked by the industry to produce standards for the NCS. An example is DNV GL-ST-E406 *Design of free fall lifeboats*, which was an assignment for Norwegian Oil and Gas."

*Overlaps*
"We operate in more than 100 countries, and develop standards in some areas which are used and recognised internationally, and which will overlap to some extent with Norsok. One example is drilling technology, where our OS-E101 standard overlaps with Norsok-D-001."

*How do DNV GL standards complement, supplement and/or overlap with maritime standards?*
"In the maritime safety regime, national maritime regulators assume that ships and mobile offshore units (MOUs) have a valid class certificate – in other words, that they meet the rules and standards of a recognised classification society. Our maritime standards therefore complement and/or supplement regulations and rules issued by such maritime authorities as the UN's International Maritime Organisation (IMO) and the Norwegian Maritime Authority (NMA). Together with classification rules and/or standards, their regulations (the IMO Modu Code and the NMA's Red Book) form the basis for achieving maritime regulatory recognition. This principle is also reflected in section 3 of the framework regulations from the PSA on the use of maritime regulations, which states that an MOU must comply with the NMA's Red Book supplemented with classification rules."

"The classification societies compete with each other, so that the maritime rules and standards from the various societies will represent competing and partly overlapping standards (such as those from the American Bureau of Shipping (ABS) and DNV GL)."

## B.4 Use of Norsok-standards versus "maritime" standards

Mobile offshore units (MOUs) are developed from maritime concepts and have a long history of observing such shipping regulations under international law as the flag state principle and international conventions on safety for vessel and crew. Examples include Safety of Life at Sea (Solas), Standards of Training, Certification and Watchkeeping (STCW), the International Safety Management Code (ISM) and the Maritime Labour Convention (MLC). Like ships, MOUs observe a classification regime, where vessels must be classed by a classification institution every five years. On a global basis, DNV GL and the American Bureau of Shipping (ABS) are the leading classification societies for MOUs and have roughly equal market shares. DNV GL dominate in Norway, but a number of MOUs also have ABS class. MOUs are naturally classed in accordance with the classification society's rules. When MOUs perform petroleum-related operations, they observe Norwegian petroleum legislation. See Proposition no 43 (1995-1996) to the Odelsting, which describes petroleum operations as follows:

To the extent that parts of the petroleum activity are conducted from MOUs, these must be regarded as facilities as a matter of law if they undertake key petroleum activities or are in other ways in direct contact with well or process facilities. This means that units conducting exploration drilling, production, including test production, processing, well testing and well workovers are to be regarded as facilities as a matter of law. To the extent that an MOU conducts well stimulation, mud treatment [or] water injection or uses equipment connected directly to a well, these are also regarded as facilities as a matter of law. Units which conduct a type of activity required during all or the most significant part of the production period and which is a precondition for or an integrated part of the production activity, such as flotels, must be regarded as facilities.

The acknowledgement of compliance (AoC) system was introduced as a result of the Lenning commission's work. It was first adopted as a voluntary scheme in 2000, but became mandatory for drilling units in 2004 and for all MOUs in 2006. The goal of the AoC system is to clarify responsibility, enhance the efficiency of the consent process and create greater predictability for players in the industry. An AoC forms part of the documentary basis when the authorities come at a later stage to consider applications for consent from operators related to the use of the facility. An AoC is particularly significant for the facility-specific part of a consent application – in other words, technical condition and the AoC owner's organisation and management system. The Norsok standards will apply for meeting the legal standard the government wishes to achieve through its regulations only when an MOU falls within the "petroleum activity" concept. Even though an MOU falls within the petroleum regulations and the PSA's area of responsibility, however, section 3 of the framework regulations provides the option to apply maritime standards in the maritime areas.

Section 3 of the framework regulations:
As regards mobile facilities registered in a national ships' register, and which follow a maritime operational concept, relevant technical requirements in the Norwegian Maritime Directorate's regulations for mobile facilities (the Red Book), such as they read after the amendments in 2007 and subsequent amendments, and with supplementary classification rules provided by Det Norske Veritas, or international flag state rules with supplementary classification rules providing the same level of safety, with the specifications and limitations that follow from Section 1 of the facilities regulations, can be used as an alternative to technical requirements laid down in and in pursuance of the Petroleum Act. The chosen maritime regulations shall be used in their entirety.

The Petroleum Safety Authority Norway can stipulate additional requirements, based on safety-related considerations.

As specified in section 3 above, this opportunity is restricted in some areas pursuant to section 1 of the facilities regulations.

Section 1 of the facilities regulations on scope:
These regulations apply to offshore petroleum activities, with exceptions as mentioned in section 4 of the framework regulations.

Requirements for facilities in these regulations also apply to installations and equipment necessary to carry out manned underwater operations from vessels.

As regards mobile facilities registered in a national shipping register, and which adhere to a maritime operational concept, relevant technical requirements in the Norwegian Maritime Authority's regulations for mobile facilities (the Red Book) as they read after the amendments in 2007 and subsequent amendments, form the basis with the following clarifications and limitations, cf. section 3 of the framework regulations:

a) Section 3 of the framework regulations only covers provisions relating to matters of a maritime character that are not directly related to the petroleum function the facility is intended to carry out. The section does not include provisions regarding:

- drilling and process equipment,
- universal audio and visual alarms,
- equipment for personnel transport and requirements for personnel transport on the drill floor,
- the working environment in general.

Over time, the references to Norsok standards in the petroleum regulations have created challenges for MOUs, since these are by their very nature designed to operate on the continental shelves of various countries. Furthermore, MOUs are built in accordance with international requirements in order to be able to move as seamlessly as possible between the various continental shelves.

Examples of Norsok standards which present major challenges in relation to maritime rules and which are perceived as "special Norwegian regulations" include Norsok S-002 *Working environment* and Norsok R-002 *Lifting equipment*. An MOU which has not been built in accordance with these standards has to undergo relatively substantial modifications in order to comply with the specified requirements. One factor which reinforces this problem is that MOUs are subject to the classification regime and are accordingly to be regarded as "new" every fifth year. This means it will have to comply with possible new requirements which have been introduced during the preceding period. That contrasts with fixed facilities, which do not have to comply with new requirements until possible major modifications.

These issues have been raised with the government on a number of occasions, both by the Norwegian Shipowners Association and by Norwegian Oil and Gas. Taking a historical view of the development of the Norsok standards, they have largely been developed by technical experts from the operator companies, while the owners of MOUs have not participated in this work to the same extent. It is the restriction on the opportunity to use maritime standards, rather than the actual level of the requirements in the Norsok standards, which creates the biggest challenge. The "difference in level" of the requirement is therefore not necessarily the biggest problem, as long as the difference in the requirement is so large that it calls for a conversion in any event.

## B.5 Transaction costs

The buyer determines which requirements will apply for a delivery. This is done when ordering the equipment or when issuing an invitation to tender to potential suppliers. The requirements have been developed by the operator company (buyer) and each equipment supplier as well as possible turnkey contractors or system suppliers if the contract is

formulated in that way on the basis of the requirements. The equipment suppliers then submit a tender based on the buyer's invitation with comments on and variations from the specifications.

To the extent permitted by the customer's invitation, the equipment supplier will base its tender on one or more suitable standard variants of the equipment component concerned. The parties then agree the final terms for the delivery, commercial terms are negotiated and requirements in the specifications are adapted and clarified. How far the customer goes in setting detailed requirements for the delivery before the supplier is involved will vary. Finally, the contract is signed and the production process initiated.

Transaction costs are incurred during this process. These arise in a supply chain for goods and services because resources must be devoted to checking availability, properties and price, negotiating a contract and checking that the delivery meets the specified requirements.

Transaction costs are driven by two main forces: the level of alignment between common interests in or goals for the transaction, and the degree of common understanding between the two parties involved in it. An attempt has been made to illustrate this in figure 11.

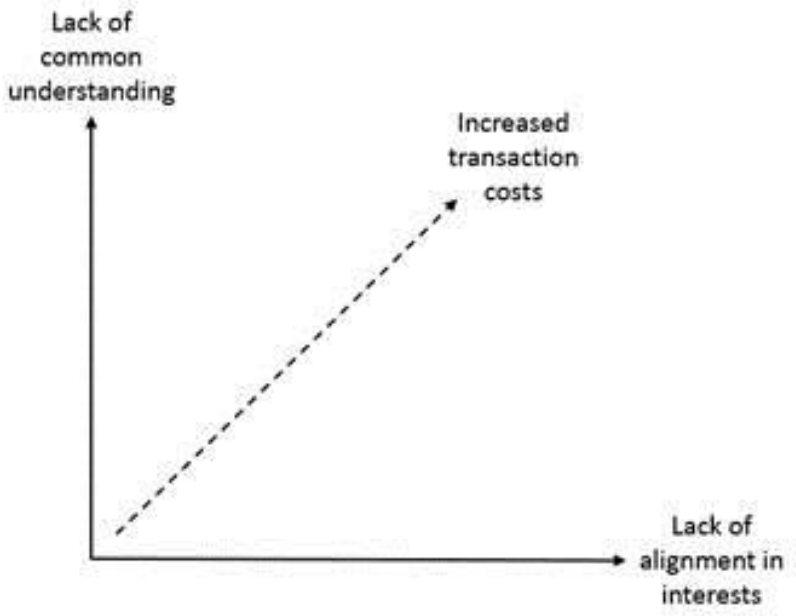


Figure 11 – Transaction costs. (Source: Statoil)

Alignment of interests should primarily be pursued through commercial agreements. The Menon report points to a failure to coordinate contractual incentives between the various parties in the supply chain. An EPC contractor, for example, has a reimbursable contract with the main supplier/operator, while its subcontractors often have fixed-price contracts.

The second force – common understanding – depends primarily on the ability to communicate exactly what expectations prevail for needs and quality, and the context in which the order has been placed. Use of a "common language" will enhance efficiency and reduce costs in the oil and gas industry's supplier chain. Generally accepted and known standards will be one of the most effective tools available in that respect. Company-specific requirements are complicated to communicate through a long supplier chair, and can provide scope for misunderstanding and error which can in turn impose substantial costs from devoting time and resources to clarification and to change and improvement work.

Studies at various economic levels (macro to micro) indicate that transaction costs can add substantially to actual production costs (or the contractual price). In ineffective markets, the mark-up could be as high as 50-75 per cent. The Menon report found that transaction costs at drilling equipment suppliers are 20-30 per cent higher for an oil company than for other customers in the oil and gas industry. So oil companies pay 20-30 per cent more than other players for the identical product.

Figure 12 shows the total costs of manufacturing individual components in newbuilds for operators and for other players. Delivery costs paid by other players are normalised at 100.

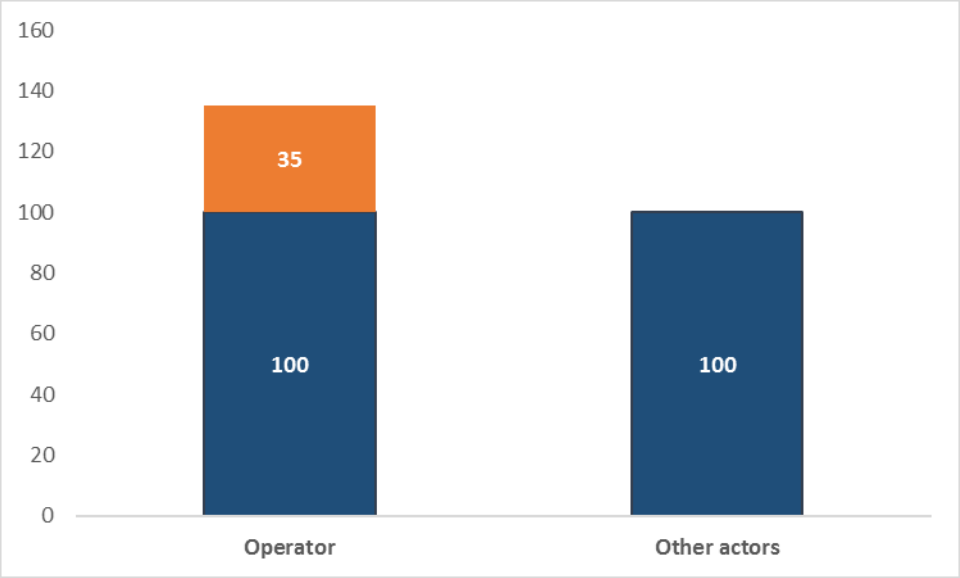


Figure 12 – Scope of transaction costs. (Source: Menon report (23))

Although other methods can also be used to establish a better common understanding as well as agreed technical and commercial terms in the value chain, the use of commonly accepted technical standards will be an effective instrument for reducing the identified transaction costs.

Transaction costs will consequently be a negative result of making extensive use of company-specific requirements.

## B.6 Competitiveness

Norway's offshore supplies industry has achieved a marked growth in international turnover during the past decade, and ranks as Norway's biggest export sector by far after oil and gas. Its annual turnover has exceeded NOK 200 billion in recent years (source: Rystad). At the same time, this is a relatively new export industry. Its foreign sales were worth some NOK 40 billion in 2003.

The sharp increase in exports by the offshore supplies sector reflects both a strong growth in the international market for offshore services and the fact that companies based in Norway deliver reputable products and services. Norwegian players increased their market shares in 2004-12.

Greater international turnover coincided with a period when both installations and rigs were increasingly built at foreign yards. Some would maintain that this occurred at the expense of Norwegian fabricators. At the same time as cost considerations led part of the production to be moved internationally, in other words, Norwegian suppliers – who generally have substantially higher outgoings that competitors in other countries – have taken market share. This reflects leading technology, expertise or quality at Norway-based companies.

Another factor is that supplier companies are exploiting the benefits of a global market. Many have established subsidiaries and operating units worldwide. Execution time is also a key criterion in choosing suppliers. With pay and costs substantially above the level at competitors in such countries as China, South Korea and much of Europe, innovation is crucial for maintaining competitiveness.

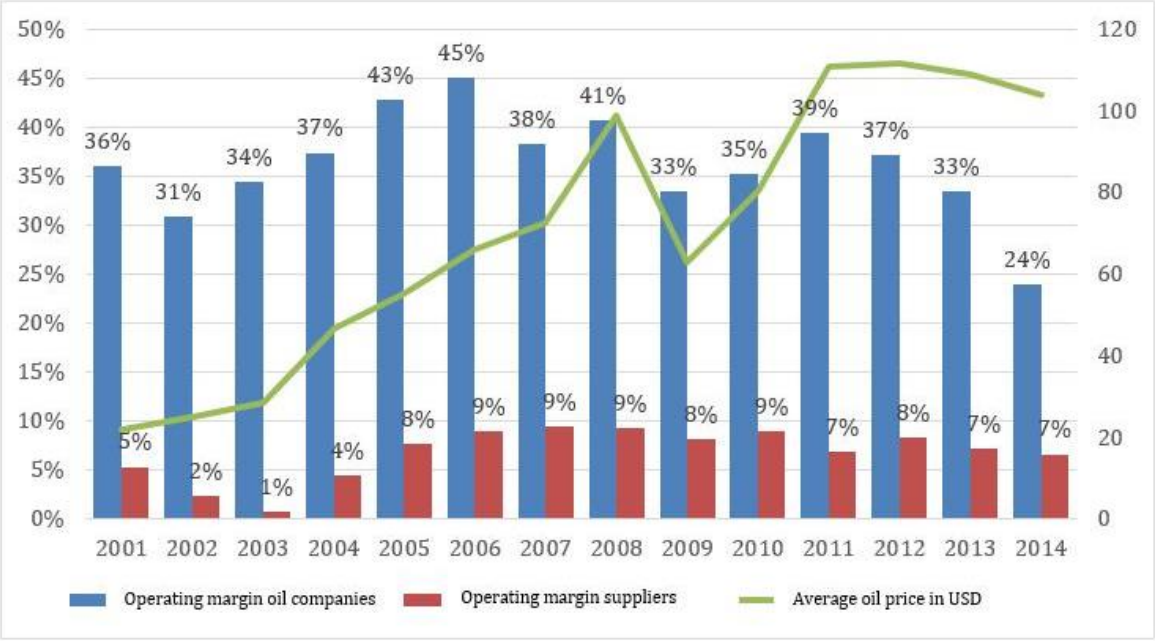


Figure 13 – Oil prices and operating margins for operators and the offshore supplies industry 2001-2014. (Source: Menon report (23))

As figure 13 shows, operating margins fell sharply for the oil companies after 2011 even though oil prices remained stable during this period. Despite oil prices rising markedly in 2001-14, operating margins among suppliers have been relatively stable. A correlation test shows a negative correlation of two per cent between oil prices and operating margins for oil companies in 2001-14. The fact that the operating margin for an industry declines when the price of what it sells rises is surprising and noteworthy. However, the explanation could be that Norway's petroleum industry has become more advanced. Resources are now recovered from more marginal fields and increasingly complex structures or reservoirs. This has probably contributed to greater investment and to a failure to capitalise on higher oil prices. But another question is whether a substantial increase in turnover, higher oil and gas prices and capacity restrictions have also led to the development of expensive standards and routines and reduced awareness of costs for a period.

The Menon report discusses how far specifications and documentation requirements could contribute to the failure of the oil companies to benefit more from high oil prices in the form of increased profitability.

Specifications and documentation requirements can help to reduce operating margins in the following ways.

1) Extensive documentation requirements can contribute to heavy use of time and resources.
2) Differences in specifications between operators could prevent companies taking advantage of economies of scale in production.
3) Experience from similar deliveries is specified as a qualification in a number of competitive tenders. This helps to reduce the number of suppliers and thereby competition. That could contribute to lower margins among operators but, viewed in isolation, should help to boost margins for suppliers.

Another factor which can affect competition is the cost of reporting and documentation. Unless these are fully covered by the customer, substantial expenses here could mean that equipment suppliers refrain from bidding and prefer other products or customers.

This would be case if the extra profit from the delivery to the oil company fails to cover the added costs of reporting and requirements. Should the added costs mean that some suppliers refrain from bidding, competition would be weakened – with the probable result that either prices rise or delivery quality falls below what it would have been more bidders.

Part of the costs are incurred as early as the tendering stage, and accordingly fall on all competing bidders. High costs associated with bidding contests make it less attractive for suppliers to take part. No less than 40 per cent of interviewees in the Menon report say they had refrained from submitting bids for customers they had not delivered to before on the ground that it was not profitable to sell equipment when a (new) complete review of specifications had to be provided. In that way, practice contributed to reducing competition and potentially to higher equipment costs for the relevant customer. “Buyer expertise” is a key word here – meaning it is possible to deliver to the oil and gas sector without devoting big internal resources and costs to understanding extensive specifications.

Reduced predictability also creates uncertainty about the potential market for a product, which can influence the willingness of suppliers to innovate. That applies particularly to suppliers with limited liquidity and which have difficulties in acquiring long-term financing for other reasons.

If it takes one-three years to develop a new prototype, the equipment supplier risks being left with a large inventory which cannot be sold if the customer has changed its mind in the intervening period about the requirements to be set for this product. A number of specific examples of this are said to exist.

Innovation can thereby be threatened by the scope of specifications. When a buyer specifies in detail what it wants to have delivered, introducing new technologies and solutions becomes more difficult. A weakening in innovation will ultimate reduce the productivity of the oil and gas industry and the Norwegian economy as a whole.

Competitiveness is important for the NCS, and the fight over investments is undoubtedly fierce. Some players have chosen to leave the NCS, and development projects must compete in any event with spending in other petroleum provinces and sectors. A competitive NCS is important for retaining knowledge and expertise in Norway. The industry has therefore done considerable work in recent years to cut costs, enhance efficiency and devote greater attention to reducing breakeven prices, choosing industry standards and simplifying – to name but a few examples.

## B.7 Cost/benefit considerations

Economic analyses and cost/benefit assessments are demanding in themselves. The HSE regulations for the petroleum industry also represent many challenges. Combining these two raises a number of issues which prompt special reflections.

The HSE regulations are largely performance-based, which means that several measures can meet the regulatory requirements and expectations. These requirements and expectations represent a minimum and, combined with demands for continuous improvement and for keeping risk as low as reasonably practicable (Alarp), mean that solutions which are satisfactory today will not necessary fulfil regulatory requirements and expectations at a later date.

This makes it difficult to define future regulatory effects, and quantifying their value is subject to great uncertainty. In other contexts, the regulations are specific and set absolute requirements.

The regulations refer to guidelines, which in turn reference recognised standards (including Norsok standards) as examples of how the regulatory requirements can be met. This means that, should a standard be amended without a change in the regulations, new requirements could be introduced which also represent a source of uncertainty when determining the effects and associated quantification of future impacts.

Another important element is that the petroleum industry operates in accordance with the precautionary principle. This means in part that the players immediately adopt the necessary compensatory measures when weaknesses, for example, are identified. The precautionary principle also means that measures must be considered – and possibly implemented – if uncertainty prevails about whether operations can be conducted in an acceptable way without changes. This principle represents a challenge in determining the actual effects, since these are uncertain. Quantification of the impact therefore also becomes highly uncertain.

Cost/benefit assessments on the use of standards (such as the Norsok ones) must also address whether the standard describes technical solutions for design and construction – and thereby represents investment costs – or whether its content provides operational guidance and can thereby be related to operating costs.

An increased investment cost can reduce operating and/or maintenance expenses. On the other hand, cutting investment costs may produce higher operating and/or maintenance expenses. Account must also be taken of where in the value chain the costs are incurred or reduced.

The costs of different measures/requirements are often easier to calculate than their beneficial effects. It can accordingly be appropriate to quantify costs before seeking to do the same for the benefits. That will ensure the best possible decision base.

Furthermore, measures can be compared and assessed in relation to each other on the cost side regardless of how far the benefits can be quantified. The cost elements included will depend on the measure.

As a minimum, investment and operating costs allocated over time should be specified. An assessment must also be made of whether an outcome could be production loss or deferment (effect on the present value of production). Figure 14 provides an example of this approach.

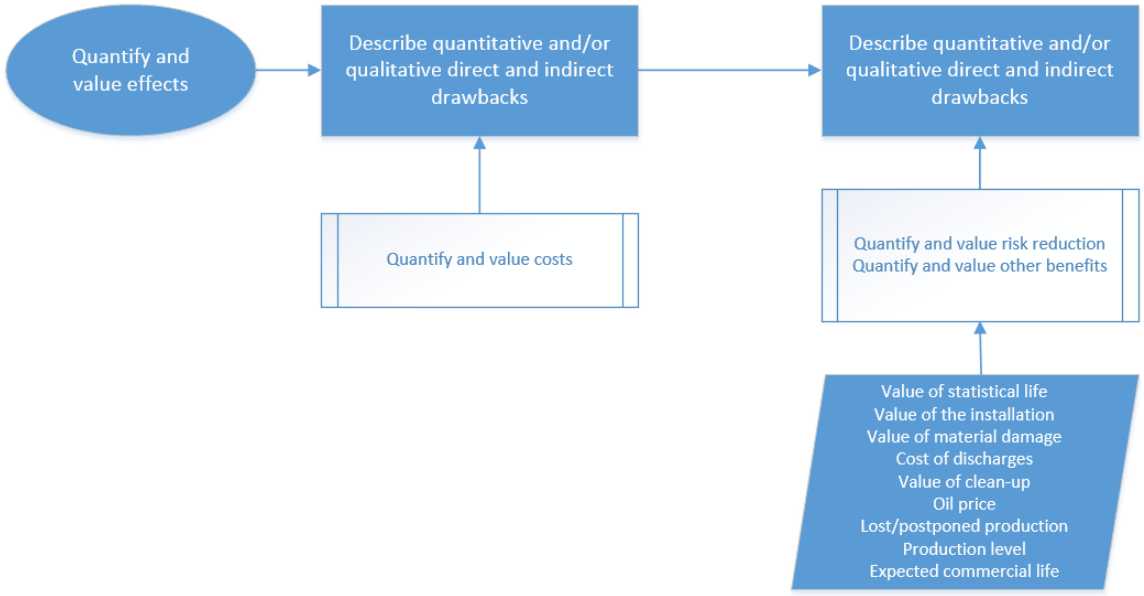


Figure 14 – Quantifying and valuing effects. (Source: Menon report (23))

## B.8 Menon publication 39/2016 – requirements as cost drivers on the NCS

This report has been prepared with support from the Petrosam II programme at the Research Council of Norway (NFR). The project owner is the University College of Southeast Norway (HSN), under the leadership of adjunct professor Erik W Jakobsen. The University of Oslo (UiO) has conducted the legal analyses, while Christian Michelsen Research (CMR) is responsible for technical analyses. Menon has supported the HSN with expertise and analyses. GCE Node, the Federation of Norwegian Industries and the Norwegian Shipowners Association have contributed financially to the programme. The Ministry of Petroleum and Energy and the NFR have provided funding through Petrosam II.

The summary from ***Menon publication 39/2016 – requirements as cost drivers on the NCS*** (the Menon report) is translated below. This report documents a number of the conditions which have also been identified through the Norsok analysis project:

"Oil companies on the NCS pay on average 20-30 per cent more than other companies in the oil and gas sector for identical products. A substantial part of this cost differential can be attributed to specifications and reporting requirements. Where equipment suppliers are concerned, costs related to administration and documentation lie several hundred per cent higher for deliveries to oil companies than to other companies in the oil and gas industry. These findings emerge from an analysis where we have reviewed accounting systems and conducted interviews with representatives for suppliers and oil companies."

"Should it generally be the case that costs for deliveries to the operators are 20-30 per cent higher, the added cost for this on the NCS would be just over NOK 50 billion in 2016. Our analysis shows that specifications and documentation requirements do not necessarily improve safety. That is partly because a number of the requirements are mutually contradictory and irrelevant for the product to be delivered. Reporting requirements can also contribute to a certain level of information overload. We therefore have a number of examples which show that the requirements can weaken safety."

"That deliveries to operators are expensive is nothing new. A number of media reports have told us about random examples where the procurement regimes at the operators have boosted costs. The new conditions identified in this report are presented below.

- Data on cost differences related to specifications and documentation requirements have been collected systematically for the first time. This has been done by acquiring information from accounting systems at a number of drilling-equipment suppliers. Data have then been extracted about the sales price of identical products to oil companies and other players in the value chain respectively. In addition to sales data, we have acquired information about procurement costs and internal use of time. Based on the findings from the accounting systems, we have interviewed 70 representatives from the offshore supplies industry, oil companies, turnkey suppliers, cluster and industry organisations, and research representatives.

- These interviews confirm our findings from the accounting systems. Equipment suppliers report that an average of 23 per cent of total production costs concern requirement-related work, but the responses range from five to 50 per cent.

- During our work, we have reviewed contracts and annexes to contracts for deliveries to the operators. In the annexes, which describe the delivery in greater detail, we find extensive use of various standards. These overlap to a great extent and specify different technical requirements. Differing specifications for such physical parameters as the height, weight and colour of a specific component mean it is completely impossible to satisfy all the requirements in the contract simultaneously.

- When reviewing the contracts, we have identified specifications which are obviously inaccurate. Reference has been made, for example, to requirements for subsea installations when ordering products to be used in entirely different parts of the production process. Since the same type of references appear in a number of sections, these specifications are likely to have become included in the contract by copying from similar documents without sufficient attention being paid to removing requirements which are obviously unsuitable.

- The scope of a contract, overlaps and the presence of clearly unsuitable requirements mean the parties negotiate after the signing of the contract on how the product or service is to be designed. Such negotiating rounds contribute to increases of several hundred per cent in administrative costs for contracts with operators.

- Outsourcing of turnkey responsibility for building installations appears to increase the scope of specifications and documentation requirements. This probably reflects a combination of turnkey responsibility with a lack of incentives to reduce costs.

- A practice involving extensive use of detailed requirements cannot be defended on safety grounds. The detailed formulation of partly overlapping requirements poses a risk of inadequate design. The scope of the documentation requirements also represents a risk of information overload, which can lead to the equipment user overlooking important details in the wealth of data. That is illustrated by the fact that 57 of 63 serious accidents on the NCS over the past decade were due to human error and erroneous use of equipment.

- The operators we have interviewed largely agree that there has been an increase in the quantity of documentation requirements and thereby costs in the long term, but that attention has been given recently to reducing this. Rather surprisingly, a number of the operators we interviewed report that equipment suppliers often deliver products which meet stricter requirements than those set by the operator company.

- The scope of specifications weakens innovation. When a buyer specifies in detail what it wants delivered, less room is provided for admitting new technology and solutions.

  Weakening innovation will eventually reduce productivity in the oil and gas industry and in the Norwegian economy as a whole. With pay and cost levels substantially above those of competitors in such countries as China, Korea and much of Europe, innovation is essential for continued competitiveness."

"Given the substantial commercial and socio-economic losses incurred as a result of specifications and documentation requirements, we make the following recommendations.

- A collective commitment among operators and suppliers to reduce the scope of specifications and documentation requirements and coordinate these to a greater extent. A similar effort was successfully made through the Norsok process in the late 1980s and early 1990s.

- For safety reasons, detailed specifications should be replaced as far as possible with performance-based requirements which describe what the unit or service will be used for. This would make it easier to adopt the latest and best technology, and make greater provision for innovation.

- To make good purchases, one must know what one is buying. The operators should make greater use of technical specialists in procurement processes. Technical specialists are better able than people with other specialities to help reduce the scale of overlapping and unsuitable requirements, and to assess the risks and benefits of proposed solutions. Technical specialists should supplement financial and legal expertise, rather than replace it."

The full report is available in Norwegian, with a separate summary in English. See the links below.

http://www.menon.no/wp-content/uploads/2016-39-Krav-som-kostnadsdriver-i-norsk-petroleumsnæring.pdf

http://www.menon.no/wp-content/uploads/Requirements-as-cost-drivers-on-the-Norwegian-continental-shelf-Menon.pdf

## B.9 PSA report on the documentation project – mapping the scope of documentation in the petroleum industry

The Petroleum Safety Authority Norway (PSA) has implemented a project to survey the scope of documentation requirements in the petroleum industry. This work resulted in a report (in Norwegian only): ***Dokumentasjonsprosjektet – Kartlegging av dokumentasjonsomfanget i petroleumsnæringen – 2015/611-01*** (24), which was presented as follows:

"Costs associated with operating on the NCS have risen over time along the whole value chain. The signs are that the documentation requirements set by the operator companies for their suppliers exceed corresponding requirements in other types of industry. These requirements for documentation are likely to have a substantial cost-driving effect in the value chain. In addition, company requirements and detailed specifications can hinder innovation and the introduction of effective and cost-saving new solutions and methods. Results from surveys conducted by the industry itself support this finding."

"A number of players in the industry assert that the quantity of documentation produced in connection with developing and operating fields and facilities on the NCS has increased significantly in recent years, even though the companies are seeking to reduce it through increased standardisation and the adoption of new, more intelligent and more effective methods."

"The PSA regards the considerable amount of documentation in the petroleum industry as a potential safety risk, in that important information needed to ensure effective and acceptable operation of the facilities can drown in the mass. At the same time, sufficient and up-to-date documentation is important in areas of significance for safety."

"On the basis of the position described above, the PSA initiated a project to map the flow and scope of documentation along the operator-main contractor-equipment supplier axis for a typical development project/major modification and on through the facility's commercial life. This mapping was pursued through a series of meetings with selected operators, contractors and suppliers in the third quarter of 2015, and the comments from these companies are reproduced in the report."

The report's summary is presented below.

"Costs associated with operating on the NCS have risen over time. The industry itself notes that the quantity of documentation produced in connection with developing and operating fields and facilities on the NCS has increased significantly in recent years, even though the companies are seeking to reduce it through increased standardisation and the adoption of new, more intelligent and more efficient methods."

"The PSA regards the substantial quantity of documentation in the petroleum sector as a possible safety risk in that important information required to ensure efficient and prudent operation of facilities could drown in the mass. At the same time, it is important that adequate and up-to-date documentation is available in areas of significance for safety."

"On the basis of the position described above, the PSA initiated a project to map the flow and scope of documentation along the operator-main contractor-equipment supplier axis for a typical development project/major modification and on through the facility's commercial life."

"The goal of the project was to map the direct and underlying causes which could have led to the growth in the quantity of documentation in the industry. Furthermore, it aims to assess whether conditions exist which could have a significance for safety."

"The mapping was pursued through a series of meetings with selected operators and contractors which sought answers to the following questions:
- what are the challenges?
- what is the background for these challenges?
- what is being done or can be done to deal with the challenges?"

"We have summarised input from the equipment suppliers, main contractors and operators in this report. These are classified in accordance with the underlying subject and the three main questions."

The PSA's report accordingly addresses a number of the same issues as the Menon study.

The PSA's report (in Norwegian only) is available under the following link:

http://www.ptil.no/getfile.php/PDF/Dokumentasjonsprosjektet%20-%20Endelig.pdf

## B.10 Norwegian Oil and Gas project on company-specific requirements

A number of anecdotes have existed in the industry about costly and excessive specifications set by companies operating on the NCS. The Norwegian Oil and Gas sector board for supplier companies wanted to establish the facts. A task force comprising supplier company representatives was appointed. Its mandate was to identify company-specific requirements as cost drivers in the Norwegian petroleum sector. This work was to be based exclusively on experience from the participating supplier companies, while keeping strictly within the bounds determined by Norwegian competition law. The report on ***Cost-driving factors – company-specific requirements*** (25) is in the process of being completed. Its summary states:

"The bulk of the work has centred on the identification of cost-driving factors related to company specifications which exceed the requirements of international standards and Norsok: Industry standards + company requirements = requested specification."

"Identified cost-driving factors have been split into nine main categories – culture, documentation, logistics, materials and nominated supplier, paint/coating, personnel, specifications, tagging and verification. Examples provided by the supplier companies in the task force are described under each main category. Some of these have been quantified and an estimate provided for the annual impact on the NCS. The additional costs are initially absorbed by the suppliers, but will be passed on to the operator companies in the longer term and contribute to a higher level of industry costs than is necessary."

"The task force recognises that reasons may exist for the company-specific requirements. However, evaluating and taking this into account has not been within the mandate for its work."

## B.11 Costs of not following common standards

An MSc thesis by Håkon Kjerkreit at the University of Stavanger was presented in the spring of 2016 under the title: ***Costs of not Following Common Standards – A Case Study of Cost Implications of Using Customer Specific Requirements Instead of Industry Standards***, (26).

The summary is reproduced below:

"In recent years, costs of subsea production systems on the Norwegian Continental Shelf has escalated. In combination with a plunging oil price, this has led to reduced margins for the companies. In order to survive, the Norwegian subsea industry need to change from being the technology driven to being cost efficient through the use of standardisation, simplification and smarter ways of working."

"With the cyclic nature of the Oil & Gas industry, cost escalations after periods of high oil price has been a returning problems. Several initiatives has been raised to facilitate standardisation of materials and testing, which has led to the development of the Norsok standards, and later the ISO 13628 standard for subsea production systems. Even if most of the major upstream companies operating on the Norwegian Continental Shelf have contributed to the development of the Norsok standards, they still apply their own set of technical requirements and test requirements for their equipment."

"This thesis investigates cost implications that arise from use of customer specific requirements, and barriers preventing use of common standards through use of methods from exploratory case studies. The study focuses on fasteners, one of the most basic

components of any system, in order to give an understanding og the challenges that exists for standardisation. The findings are discussed for how they can be relevant for other types of equipment used in the subsea industry. Fasteners are by their nature ideal for mass production. However, the market for fasteners in subsea use is rather small on a global scale. This makes standardisation and well-considered fastener selection critical in order to achieve benefits of scale."

"The findings indicate that the requirements imposed by oil companies are not the most decisive cost drivers. Rather it is the lack of coordinating of requirements between companies and standards, and the large number of different fasteners in use that are found to be the main cost drivers. In addition, the procurement strategy applied by most companies promotes low volume orders, and thus does not give room for production to achieve production optimum quantities."

"In the period 2010 – 2011 the price of one of the analyzed fasteners increased 60 times. This coincides with the launch of revision 2 of Statoil's Technical Requirement 3101 (TR 3101). Parts of these costs were related to the introduction of fastener traceability, which had not been sufficient before the release of the TR. The price has declined as fastener manufacturers have become familiar with the new requirements. However, the average price is still over ten times the original for the part number analyzed."

## B.12 Edvard Grieg – experience from Lundin Norway AS

The project secretariat asked Lundin Norway AS to sum up its experience of using Norsok standards in connection with the development of Edvard Grieg. This project was chosen because it represents one of the latest Norwegian offshore fields to come on stream. The response from Lundin Norway is reproduced below:

"This chapter provides a brief summary of the use of Norsok standards in the Edvard Grieg project in certain disciplines, plus a summary of Lundin's experience related to this."

"The note is a summary of the experiences presented to Norwegian Oil and Gas in the spring of 2016, and builds primarily on subjective experience gathered from the project's discipline leaders in the following areas:

- process
- mechanical
- material
- HSE/technical safety
- electrical
- instrumentation."

"The Edvard Grieg project has essentially been conducted on a 'Norsok alone' basis. Lundin as operator has not drawn up requirements which supplement those in the Norsok standards."

"During the front-end engineering and design (Feed) phase, the project's engineering contractor for this work has drawn up project-specific requirements which mainly reflect technical clarifications made in the preliminary project phase as well as relevant experience from earlier projects."

"A review of the Norsok standards used reveals substantial differences between the content of the various standards. The majority are regarded as current, reflect the state of the art and have been revised in line with technical advances. However, some are out of date without having been withdrawn. Certain standards specify

specific technical requirements, some are more performance-oriented, while others again contain only recommendations. Certain standards are regarded as cost drivers, while others are felt to save costs."

"The Norsok standards are often used uncritically. Requirements primarily intended for critical systems are often implemented for less critical utilities. Such a practice is a cost driver in itself."

Process

"Relevant standards are Norsok P-001/100 (now merged as P-002). The standard is regarded as an adequate starting point for a standard NCS offshore installation. However, it could be a cost driver if applied uncritically to "simpler" installations, such as unmanned platforms, installations with a short production life and so forth."

The standard formed the basis for system design. Possible alternative international standards have not been applied in addition to or in place of P-002 for general process system design."

Mechanical

"Relevant standards are:

- R-002 *Lifting equipment*: The standard was revised in 2012 and is regarded as very current and applicable within the relevant area
- R-001 *Mechanical equipment*: The latest revision was in 1997, and should be updated because a number of the references are no longer valid. Mechanical data sheets appended to the standard have been replaced with API/ISO data sheets
- R-004 *Piping and equipment insulation*. The standard has largely been replaced by a project-specific specification developed in the Feed phase which, in addition building up the individual insulation classes, also specified requirements for execution. This area is in continuous development, and constantly updating Norsok in line with progress is demanding."

Material

"Broad use has been made of most Norsok standards in the project. One objection is that these are often used uncritical and implemented for all main and utility equipment and for all components in mechanical package deliveries. This has been a cost driver in many cases, and provides little opportunity for using standard equipment from suppliers. Certain product standards also contain a number of supplementary material technology requirements which conflict with Norsok material requirements over and above referenced international standards. Uncritical use of Norsok material standards for such projects, where they are not intended to apply, is problematic and unfortunate."

"Norsok M-501: *Surface preparation and coating protection* has been applied without taking adequate account of the environmental requirements to which the relevant components are exposed. The standard is also little known to certain subcontractors."

HSE/technical safety

"The Norsok standards have been widely applied in safety, the working environment, the natural environment and HSE. Most of the standards are considered to provide cost-efficient solutions, without excluding supplier-specific solutions. However, certain standards set strict requirements for documentation

which could be a cost driver without providing sufficient value added. Some possible improvement areas are listed below.

- S-001 *Technical safety* (edition 4, February 2008). Improvement potential: requirements for fire insulation.
- Z-013 *Risk and emergency preparedness assessment* (rev 3, October 2010). Improvement potential: more effective risk analysis.
- C-004 *Helicopter deck on offshore installations* (edition 2, May 2013). Supplement to aviation regulations. Can possibly be covered by other Norsok C standards.
- R-002 *Lifting equipment* (edition 2, September 2012). Mismatch between DNV standard for lifeboats and R-002 concerning full-scale fall.
- S-002 *Working environment* (rev 4, August 2004). Improvement potential: Arctic areas/winterisation.
- S-005 *Machinery – working environment analyses and documentation* (rev 1, March 1999). Outdated.
- C-001 *Living quarters area* (edition 4, March 2015). Does not cover utility areas well enough (2006 edition).
- S-006 *HSE evaluation of contractors* (rev 2, December 2003): Unnecessarily detailed."

Electrical

"Relevant standard: Norsok E-001 *Electrical systems*.

Where electrical installations are concerned, the mandatory requirements must accord with international standard IEC 61892 *Mobile and fixed offshore units – electrical installations* and associated IEC standards. Norsok E-001 is not referenced for construction requirements, and is therefore not a mandatory standard.
E-001 only provides guidance related to such systems as electrical protection.
E-001 should be able to provide additional guidance in such areas as:

- relay protection for electrical systems, particularly with regard to generator relay protection
- definition of emergency generator's functions – unclear/inadequate references to IEC standard for protection functions related to emergency generator in emergency mode
- power management system (PMS) functions and solutions."

Instrumentation

"Comments on the individual standards.

- I-001 F*ield instrumentation*. Data sheet formats are much used. Well-known among suppliers, including internationally. The standard contains too many references. Is not read by suppliers/contractors. Standardisation provides cost-effective solutions for operation, but can increase procurement costs.
- I-002 *SAS*. The standard is undated (2001). Development of control systems is not covered. Calls for project-specific specification for project specialisation and implementation of new technology (SAS package specification).
- I-005 *System control diagram*. Very important specification which is used down to the smallest detail. All control system players on the NCS can use it. The standard must be kept continuously updated because of developments in technology and regulatory requirements. No better international standards are available for standardisation of SAS software.

- I-104/105 *Metering*. Very important specifications, important for compliance with government requirements. All players on the NCS can use this. The standard must be kept continuously updated because of developments in technology and regulatory requirements.
- Z-010 *Electrical, instrumentation and telecommunication installation* has been withdrawn. Using this as a basis, the project drew up a project-specific installation specification which corresponded closely with Z-010. It is recommended that preparation of a separate Norsok standard for EIT installation be considered."

## B.13 Success stories from using Norsok standards

Standards Norway has published a number of success stories which demonstrate the benefits of using standards in general and Norsok in particular. These can be found with the following links.

http://www.standard.no/standardisering/suksesshistorier/suksesshistorie-fmc/

http://www.standard.no/standardisering/suksesshistorier/suksesshistorie-statoil/

http://www.standard.no/standardisering/suksesshistorier/suksesshistorie-mhwirth/

http://www.standard.no/standardisering/suksesshistorier/suksesshistorie-petroleumstilsynet/

http://www.standard.no/standardisering/suksesshistorier/suksesshistorie-teekay/

http://www.standard.no/standardisering/suksesshistorier/suksesshistorie-statoil1/

An article in Norwegian from *E24* is also included as an example of media coverage of standardisation-related activities in the companies. This covers Statoil's commitment to standardisation and industrialisation.

http://e24.no/energi/statoil/statoil-topp-om-standardisering-min-trapp-til-himmelen/22755286

## B.14 Competitiveness – the changing NCS

KonKraft is a collaboration arena for Norwegian Oil and Gas, the Federation of Norwegian Industries, the Norwegian Shipowners Association and the LO as well as the United Federation of Trade Unions and the Norwegian Union of Industry and Energy Workers (Industry Energy), which are both LO members. Its name is an abbreviation of the Norwegian word for competitiveness (on the NCS).

The arena is currently establishing a committee to work on an initiative called *Competitiveness – the changing NCS*. This will pursue such key issues as the way technology development and other factors can help to run the NCS more efficiently. It will also deal with petroleum standardisation. Recommendations from the Norsok analysis project, including aspects which have been addressed by the project but are not a direct part of its mandate, will be important inputs to the KonKraft work. Furthermore, the work done on standard contracts will contribute to this initiative.

## B.15 "Reversing the trend"

The Petroleum Safety Authority Norway (PSA) published in November 2016 a journal called "Dialogue" – no 2/2016. The title was: "Reversing the trend – How will your company and your organisation contribute?":

"Norway has 50 years of oil history behind it. But what will the next chapter of its saga look like? Did developments take a wrong turn? Or was the country able to reverse the worrying trend of the past two years?"

"We have decided to focus work with the 2017 main issue on three defined areas.

- Collaboration
- Robustness
- Standardisation"

"Standardisation – Norway's petroleum sector has been among the leaders for standardisation and the use of standards. We are now observing a trend which can threaten the norms forming the basis for the functional HSE regulations."

Given that the petroleum industry never before has focused more on petroleum standardisation, including top management involvement, awareness and direct financial contributions to petroleum standardisation has increased considerably over the last few years and in addition being supplemented by self-funded work on standardisation by the industry estimated to be worth almost NOK 30 – 50 million per annum, the Norsok owners find it reasonable to question the PSA's statements.