DET NORSKE VERITAS

Report

OLF/NOFO - Summary of differences between offshore drilling regulations in Norway and U.S. Gulf of Mexico

Oljeindustriens Landsforening/Norsk Oljevernforening For Operatørselskap

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OLF/NOFO - Summary of differences between offshore drilling regulations in Norway and U.S. Gulf of Mexico	DET NORSKE VERITAS AS P.O.Box 300 1322 Høvik, Norway Tel: +47 67 57 99 00 Fax: +47 67 57 99 11 http://www.dnv.com Org. No: NO 945 748 931 MVA
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Summary:

DNV has summarised the Norwegian and U.S. offshore drilling regulations for Mobile Offshore Drilling Units (MODUs) and compared the Norwegian and the U.S. regulatory regimes. The work was limited to regulations, as per April 2010, related to rig and facilities, to drilling and well operations, and to oil spill preparedness.

The comparison has been carried out by a multidisciplinary project team with knowledge of both Norwegian and U.S. regulations, located at DNV offices in Norway and US. This report presents an overview of the regulatory regimes for offshore drilling and the identified difference in the regulations. DNV has identified several similarities but also a number of differences.

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CONCLUSIVE SUMMARY

DNV has compared the Norwegian and the U.S. Gulf of Mexico offshore drilling regulatory regimes and regulations for drilling with Mobile Offshore Drilling Units (MODUs). The study identified several similarities, but overall there are fundamental differences between the two countries' regulations. It has been made on behalf of Norwegian Oil Industry Association (OLF) and Norwegian Clean Seas Organisation for Operating Companies (NOFO).

The comparison is limited to regulations, as per April 2010, related to rig and facilities, to drilling and well operations, and to oil spill preparedness. The scope of the project does not consider how the regulations are complied with in the U.S. and Norway and does not include any considerations of causes of the Deepwater Horizon Accident. Neither has the study included any evaluations of the suitability of the different regulations nor the effectiveness of safety management practices among operators and suppliers. The approach being applied has mainly been a factual and technical comparison.

A multidisciplinary project team with knowledge of both Norwegian and U.S. regulations, located at DNV offices in Norway and in the U.S. has carried out the study. The report has been submitted on external hearing to selected operators in the U.S. and in Norway in addition to OLF and NOFO.

Among the main differences with respect to regulatory regimes identified in the report the Norwegian regulations are primarily performance and risk based, whereas the U.S. regulations are dominantly prescriptive and do not require the application of systematic risk management practices.

Consequently, the Norwegian performance based regulations specify the performance or function which is to be attained or maintained by the industry. The regulatory role here involves defining the safety standards and acceptance criteria which companies must meet. Norway's intention of such a regulatory regime is to get the operator to be focused on and be "self-regulatory" when it comes to Health, Safety and Environment (HSE) performance, rather than relying on the regulator's efforts in controlling that the HSE requirements are met. Within the Norwegian regime it is to a larger degree a responsibility for the operator to demonstrate how their safety management system and performance comply with the regulations (e.g. the regulations for drilling and well operations).

Through prescriptive regulations in the U.S. specific technical requirements are defined for structures, technical equipment and operations in order to prevent accidents and mitigate hazards. The regulatory authorities define the requirements for HSE, and monitor that the companies comply with these. There is no specific requirement to establish a safety management system, and performance criteria and acceptance criteria are applied in only a limited extent in the U.S. offshore drilling regime compared to the Norwegian regime.

The major difference in the regulations on well design, drilling and well operation is the Norwegian requirement for a systematic application of two independent and tested well barriers in all operations. No similar systematic requirements for well barriers are found in US. In Norway, there is also requirement for an additional casing shear ram in the blowout preventer, (BOP) for dynamic positioned mobile offshore drilling units (MODU's), and to recertification of well control equipment every fifth year. This is not a requirement in the U.S.

A summary of the findings in this report is as follows:

Regulations and Regulatory regimes, section 2:

- The Norwegian regulations are mainly performance-based with supplementary prescriptive requirements while the U.S. regulations are primarily prescriptive.
- The Norwegian regulations are mainly risk-based, while U.S. regulations do not require participants in offshore drilling activities to systematically identify and mitigate risks.
- In Norway the authority for resource management is separated from the authorities for HSE management, while in the U.S. both are handled within the same authority (as per April 2010).
- In both countries there are various authorities having different responsibilities. In Norway the PSA has the coordinating role in development and supervision of HSE regulations. In the U.S. this responsibility is shared between the different authorities.
- In Norway, it is the overall responsibility of the Operator to ensure a safe and prudent operation of the entire petroleum activities in line with the regulations. In the U.S. this responsibility is shared between the operator and the authorities through prescriptive requirements and authority approvals.

Regulations to management systems, section 3:

- Norwegian regulations cover requirements to establish and maintain a documented HSE management system while in the U.S. adoption of a Safety and Environment Management Program (SEMP) is voluntary.
- In Norway the HSE regulations specifically states once to whom (e.g. operator, licensee, contractor etc) the HSE requirements are directed. In the U.S. the responsibility for adherence to requirements within specific areas is defined in various parts of the individual regulations.
- In Norway the operator shall see to it that everyone carrying out work for him (e.g. contractor) complies with regulatory HSE requirements (the duty “to-see-to-it”). There is no similar requirement in the U.S.
- There are no general requirements in place in the U.S. regulations for systematically establishing barriers with the same meaning as in the Norwegian regulations where technical, operational or organisational barriers are included.
- There is a general requirement in Norway that there shall be adequate competence in all phases of petroleum activities. In the U.S. there is competence requirements related to a few critical activities or operations. However, the study has not identified any overall requirements to competence in drilling operations.

Regulations for drilling and well activities, section 4:

- Norwegian regulations require two independent and tested well barriers to prevent unintentional flow from the formation into another formation or to the surface in the case

of an unwanted event. If drilling with a riser margin is not possible due to deep water and narrow pressure margin additional risk reducing measures shall be implemented, for example by having both casing shear and shear seal ram. No similar requirements to well barriers are found in U.S.. NORSOK D-010 defines how the barrier requirements should be applied in all drilling and well operations.

- For well design, Norwegian regulations leave it to the operator to show compliance to their safety philosophy. U.S. regulations set detailed requirements to the content of the Application for Permit to Drill which shall be approved by MMS.
- For pressure control equipment, Norwegian regulations require recertification of Blowout preventers (BOPs) every fifth year while U.S. regulations do not require recertification (as per April 2010).

Regulations to facilities and drilling systems, section 5:

- For the BOP, Norwegian regulations require an additional casing shear ram to the blind shear ram for dynamic positioned mobile offshore drilling units (MODU's), while the U.S. regulations do not.
- Norwegian regulations require an alternative activation system of the BOP and a system that ensures release of the riser before a critical angle occurs due to loss of position of the drilling unit. Equivalent mandatory requirements have not been found in the U.S.
- The scheme in Norway requires that the latest edition of applicable regulations and referred standards shall be used as basis for compliance evaluations, Acknowledgement of Compliance (AoC), irrespective of a unit's age. No such requirements applies for the U.S. part of GoM.

Regulations to oil spill preparedness, section 6:

- The Norwegian emergency preparedness against acute pollution is risk based. Hence the capacity and design of oil spill preparedness is specific for the offshore installation or exploration drilling location and is based on environmental risk assessments. The U. S. emergency preparedness against acute pollution is "worst case discharge" based.
- In Norway the effectiveness of oil recovery systems are calculated dependent of the area specific weather, operational light and oil weathering data. In the U. S. the capacity is set by reducing the given manufacturers specification of collection capacity with 80 %.
- The Norwegian oil spill response strategy is mainly based on a mechanical/physical recovery. Dispersion chemicals are only used in a limited extension and in-situ burning is only considered used in ice infested areas. In the U.S. in general, spill cleanup techniques fall into six categories including, but not limited to: mechanical/physical recovery, in situ burning, bioremediation, dispersant, natural remediation, and additives such as herding agents and polymers.

- Neither in Norway nor in the U. S., the functions and capacity of the oil spill response equipment are checked or certified in a standardised manner by an independent third party.

1 INTRODUCTION

1.1 GENERAL

The Norwegian Oil Industry Association (OLF) and Norwegian Clean Seas Organisation for Operating Companies (NOFO), have asked DNV to summarize the differences between Norwegian and U.S. offshore drilling regulations for dynamic positioned Mobile Offshore Drilling Units (MODUs) and compare the two countries' regulations and regulatory regimes.

The summary of differences is intended to provide OLF with an objective and factual basis for discussions and learning in the wake of the Deepwater Horizon accident.

The comparison has been carried out by a multidisciplinary project team with knowledge of both Norwegian and U.S. regulations, located at DNV offices in Norway and the U.S.. During the study a draft report has been commented on by external subject matter experts at operators in Norway and in the U.S. and by OLF and NOFO.

The results are divided into five main sections:

- Section 2 gives a description of the regulatory regimes in Norway and the U.S. covering a general description of the regulations as well as a description of the regulatory bodies and their regulations.
- Section 3 describes differences in management requirements.
- Section 4 describes differences in requirements to offshore drilling activities.
- Section 5 describes differences in requirements to facilities for specific chosen systems.
- Section 6 describes differences in requirements to oil spill preparedness

The Norwegian regulations and regulatory regime formed the basis for the description of the differences between the Norwegian and the U.S. regulations and regulatory regimes. Norwegian regulations have been basis for this summary of differences with the aim to determine the equivalent U.S. regulations. Due to fundamental differences in the Norwegian and U.S. regulatory structures, there might be U.S. equivalents which have not been identified to all principles in the Norwegian regulations.

The report refers to regulations as per April 2010, and updated information after the Deepwater Horizon incident in the GoM has not been assessed.

The "U.S. regulations" as referred to in the report means the U.S. regulations limited to the Gulf of Mexico (GoM).

1.2 SCOPE OF WORK

The scope of work within this report covers the following tasks:

- Identification of the main differences between the Norwegian and Gulf of Mexico regulations covering these areas:
    - Regulations for rig and facilities
    - Regulations for drilling and well operations
    - Regulations for Oil Spill Preparedness
    - Overall management system regulations for petroleum operations
- Summarization of the main characteristics of the regulations in the U.S. and Norway and a summary of the main differences
- Description of the main characteristics of the regulatory body regimes in the U.S. and Norway and a summary of the differences

During the work to identify differences between the regulations and regulatory regimes, the focus was limited to:

- Offshore drilling operations in the Gulf of Mexico (GoM)
- Dynamically positioned Mobile Offshore Drilling Units (MODU)
- Major safety and environmental risks
- Selected regulatory requirements (and information about regulatory bodies and regulatory regime) that are considered relevant for prevention of major accidents during drilling operations (blowouts, fires, explosions, etc)
- The U.S. regulations and regulatory regime that are relevant for the GoM
- Information/facts about regulations and regulatory regimes valid as per April 2010

1.3 LIMITATIONS AND ISSUES NOT CONSIDERED BY THIS REPORT

The following have not been considered in this report:

- Any considerations related to the Deepwater Horizon accident
- Any issues related to health, work environment as well as cultural aspects, are not treated in this report. This has been done to limit the size of the scope in this report and not because the issues are not relevant aspects in major accident scenarios
- Changes in regulations and regulatory regimes after April 2010
- Implementation of the regulations by petroleum companies
- Development of regulations
- Best practices
- Specific requirements only covered by the U.S. regulations have not been emphasized in the report
- How the regulations in practice are enforced by governments

- Any evaluations or analyses of the identified differences between the Norwegian and the U.S. GoM regulations and regulatory regimes
- Any evaluations or opinion about the safety and environmental performance level on the Norwegian Continental shelf or the Gulf of Mexico
- Information about the Norwegian petroleum regulations under the Norwegian Petroleum Directorate (NPD) that relate to safeguarding the overall resource management considerations on the Norwegian Continental Shelf
- Drilling and well facilities emphasized into marine systems, structures and operations

1.4 METHODOLOGY

This report contains gap analyses that have been performed to identify the differences in regulatory requirements for management (section 3), drilling and well activities (section 4), facilities and drilling systems (section 5) and oil spill preparedness and response (section 6).

The Norwegian regulations have been used as the basis for identification of differences. Specific Norwegian requirements have been compared to U.S. requirements that wholly or partly match the Norwegian requirement. Accordingly the differences have been expressed as how the U.S. regulatory requirements differ from the Norwegian. The method has also been used to identify general differences in regulatory regimes where appropriate.

For identification of differences in management requirements (section 3) selected management system areas based on specific sections (paragraphs) in the Norwegian regulations were defined as basis for the comparison. These areas and requirements are considered relevant for the focus of the project (see the description in section 1.2) and defined by the scope of work.

For each of the different management areas a summary of the identified regulatory differences have been prepared (see section 3.1 – 3.12). The presentation of these have been based on one or several gaps from the gap analysis dependent on the detailing level of the requirements and the significance of each single gap (i.e. difference) in relation to prevention of major accidents.

The gap analysis for management requirements does not include requirements in standards referred to in guidelines for the Norwegian regulations.

For comparison of technical and operational regulatory requirements in sections 4, 5 and 6 standards referred to in guidelines in the Norwegian regulations have been considered. Referenced standards are voluntary as the term “should” is used (see the description about this in section 2.2.2). These standards demonstrate the level of performance recommended by the authorities. If applying alternative standards, the same level of performance is required.

In section 6 major accident oil spill scenarios associated with offshore drilling operations and oil spill response with relevant requirements and regulations have been considered.

In general the identification of the differences between the Norwegian and the U.S. regulations is demanding as one specific Norwegian requirement might be covered by multiple U.S. requirements in different regulatory documents (e.g. CFR's).

1.5 DEFINITIONS AND EXPLANATIONS

Term	Reference	Page No.
Performance-based regulatory system	Fact box 1	p. 17
Prescriptive regulatory system	Fact box 1	p. 17
Risk-based regulatory system	Fact box 2	p. 18
Risk	Fact box 2	p. 18
SEMP and SEMS	Fact box 3	p. 36
Barrier	Fact box 4	p. 39
Riser margin	Fact box 5	p. 55
Dynamic positioning systems	Fact box 6	p. 63

1.6 ABBREVIATIONS

Term	Description
AC	Area Command (U.S.)
ACP	Area Committee Plan (U.S.)
ALARP	As Low As Reasonably Practicable (used in relation to risk acceptance)
AoC	Acknowledgement of Compliance (Norway)
AfC	Application for Consent (Norway)
APD	Application for Permit to Drill (U.S.)
APM	Application for Permit to Modify (U.S.)
AR	The Activities Regulations (Norway)
BAST	Best Available and Safety Technology (U.S.)
BMP	Best Management Practices (U.S.)
BOP	Blowout Preventer
CAA	Clean Air Act (U.S.)
CDC	Center for Disease Control and Prevention (U.S.)
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (U.S.)

Term	Description
CFR	Code of Federal Regulations (U.S.)
COI	Cerificate Of Inspection (U.S.)
COTP	USCG Captains of the Port (U.S.)
CVA	Certified Verification Agency (U.S.)
CWA	Clean Water Act of 1977 (U.S.)
DCS	Distributed Control Stations
DCV	Directional Control Valve
DOCD	Development Operations Coordination Document (U.S.)
DOI	Department of Interior (U.S.)
DP	Dynamic Positioning
DPA	Deepwater Port Act (U.S.)
DPP	Development and Production Plan (U.S.)
DWOP	DeepWater Operating Plan (U.S.)
EDS	Emergency Disconnect Sequences Systems
EP	Exploration Plan (U.S.)
EPA	Environment Protection Agency (U.S.)
EQD	Emergency Quick Disconnect
ESD	Emergency Shut-Down
EU/EEA	European Union/European Economic Area
F&G	Fire and Gas
FAI	Fail-As-Is
FAR	Fatal Accident Rate
FaR	The Facilities Regulations (Norway)
FEMA	Federal Emergency Management Agency (U.S.)
FR	The Framework HSE Regulations (Norway)
(F) OSC	(Federal) On Scene Coordinator (U.S.)
FSC	Fail-Safe-Close
FWPCA	U.S. Federal Water Pollution Control Act
GoM	Gulf of Mexico
HPU	Hydraulic Power Unit
HSE	Health, Safety and Environment Norway) Note that this field encompasses safety, working environment, health, external environment and financial assets, the latter including production and transport regularity (operational availability). Ref. guideline for FR Sec.2.

Term	Description
ICS	Incident Command System (U.S.)
IDR	The Information Duty Regulations (Norway)
IKLØ	Inter municipal management exercise
IMO	International Maritime Organisation
ITL	Information to Lessees and Operators (U.S.)
Klif	Climate and Pollution Agency (Norway)
LMRP	Lower Marine Riser Package, ref. ISO 13628-7
LWRP	Lower Workover Riser Package, ref. ISO 13628-7
MMS	Minerals Management Service (U.S.)
MoA	Memorandum of Agreement (U.S.)
MODU	Mobile Offshore Drilling Units
MoU	Memorandum of Understanding (U.S.)
MPE	Ministry of Petroleum and Energy (Norway)
MR	The Management Regulations (Norway)
MTSA	Maritime Transportation Security Act (U.S.)
NCA	Norwegian Coastal Administration
NCP	National Contingency Plan (U.S.)
NCS	Norwegian Continental Shelf
NEPA	National Environmental Policy Act (U.S.)
NIMS	National Incident Management System (U.S.)
NEBA	Net Environmental Benefit Analysis (Norway)
NMD	Norwegian Maritime Directorate
NOAA	National Oceanic Atmospheric Administration (U.S.)
NOFO	Norwegian Clean Seas Organisation for Operating Companies
NORSOK	The competitive standing of the Norwegian offshore sector. (NORsk SOkkels Konkuranseposisjon)
NPD	Norwegian Petroleum Directorate
NPDES	National Pollutant Discharge Elimination System (U.S.)
NR	Norwegian Shipowners Association
NRT	National Response Team (U.S.)
NTL	Notice to Lessees and Operators (U.S.)
OCSLA	Outer Continental Shelf Lands Act (U.S.)
OLF	The Norwegian Oil Industry Association
OPA 90	Oil Pollution Act of 1990 (U.S.)

Term	Description
OPRC	International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (IMO)
OCS	Outer Continental Shelf (U.S.)
OSHA	Occupational Safety and Health Administration (U.S.)
OSRO	Oil Spill Removal Organizations (U.S.)
OSRP	Oil Spill Response Plan (U.S.)
PDO	Plan for Development and Operation (Norway)
PINC	Potential Incident of Noncompliance (U.S.)
PREP	The U.S. National Preparedness for Response Exercise Program
PSA	Petroleum Safety Authority (Norway)
QI	Qualified Individual (U.S.)
ROV	Remote Operated Vehicle
RF	Regulatory Forum (Norway)
RRT	Regional Response Team (U.S.)
RSPA	Research and Special Programs Administration (U.S.)
SEM	Subsea Electronic Module
SEMP	Safety and Environmental Management Program (U.S.)
SEMS	Safety and Environmental Management System (U.S.)
SIL	Safety Integrity Level, ref. IEC 61508
SMT	Spill Management Team (U.S.)
SONS	Spills of National Significance (U.S.)
SROT	Spill Response Operating Teams (U.S.)
SSC	Scientific Support Coordinators (U.S.)
UC	Unified Command (U.S.)
USC	United States Code
USCG	U.S. Coast Guard
WCD,	Worst Case Discharge (U.S.)
WOCS	WorkOver Control Systems, ref. ISO 13628-7

2 REGULATIONS AND REGULATORY REGIMES

2.1 INTRODUCTION

This section gives an overview of the Norwegian and U.S. regulations for offshore drilling in general, section 2.2. The relevant regulatory bodies are described in section 2.3.

2.2 THE REGULATIONS – IN GENERAL

2.2.1 SUMMARY OF DIFFERENCES

The differences in the regulations in general, can be summarized as follows:

- The Norwegian regulations are mainly performance-based with supplementary prescriptive requirements while the U.S. regulations are primarily prescriptive. See Fact box 1.
- The Norwegian regulations are mainly risk-based, while U.S. regulations do not require participants in offshore drilling activities to systematically identify and mitigate risks. See Fact box 2.
- In Norway, the regulations are common for all parties involved in the petroleum activities, while the U.S. has a complex structure with several authorities and several formal documents, and where the formal documents are made available at different web sites
- In Norway, it is the overall responsibility of the Operator to ensure a safe and prudent operation of the entire petroleum activities in line with the regulations. In the U.S. this responsibility is shared between the operator and the authorities through prescriptive requirements and authority approvals.
- The Norwegian regulation with its performance based structure is clear as regards the requirements versus guidelines (see the description about “shall” and “should” in section 2.2.2) and to whom the requirements are directed. However, performance-based regulations are in general more challenging with respect to use compared with prescriptive regulations. See Fact box 1.

  The U.S. regulations are not always specific, and many requirements are general and not clear. It is not either clear whether Notice to lessees and Operators (NTLs) and Information to Lessees and Operators (ITLs) are mandatory or voluntary.

2.2.2 THE NORWEGIAN REGULATIONS

Formal documents and legal basis

The regulations for petroleum activities on the Norwegian Continental Shelf are common to the Ministry of Labour, the Ministry of the Environment and the Ministry of Health and Care Services in the field of health, safety and the environment (HSE). The aim of introducing a set of

common regulations is to secure a regime of regulation and supervision of health, safety and the environment in the petroleum activities that is as coherent and coordinated as possible.

The PSA is the coordinator for development of the petroleum regulations and for monitoring compliance with these regulations. The regulatory regime embraces this coordinating role in relation to other regulators with independent authority in the HSE area. See more about this in section 2.3.2.

The HSE regulations specific for the offshore petroleum industry include:

- The Framework Regulations
- The Management Regulations
- The Information Duty Regulations
- The Activities Regulations
- The Facilities Regulations

The Framework Regulations provide a framework for coherent and prudent petroleum activities and contain provisions on, inter alia, scope, obligated party (responsibility), principles relating to risk reduction, application of maritime legislation as an alternative to technical marine requirements in the regulations, principles relating to health, safety and the environment, including requirements to a favourable HSE culture; working hours, periods of stay and off-duty time.
The regulations emphasise employees' right to contribute to all processes likely to have a bearing on health, safety and the environment in the petroleum activities; ref. Framework Regulations Sec 6 on arrangements for employee contribution.

The scope of the regulations is set out in the Framework Regulations Section 2 Subsection 1. The concept health, safety and the environment is used as a blanket expression to describe the entire scope of the regulations. This concept has to be understood in the light of the health, safety and environment legislation. See the clarification under “Further about the regulations” above.

The Management Regulations assemble all overarching requirements to management in the field of health, safety and the environment. They contain requirements to, inter alia, risk reduction, management elements, resources and processes, analyses and measuring, follow-up and improvement.

The Information Duty Regulations set requirements to material and information to be submitted or made available to the authorities. The regulations provide for electronic administrative procedures. They contain requirements to inter alia, applications for consent (AfC), alerts, notification and reporting.

The Facilities Regulations regulate the design and outfitting of facilities, such as safety functions and loads, materials, work areas and accommodation areas, physical barriers and emergency preparedness.

The Activities Regulations regulate the conduct of various activities and set requirements to, inter alia, planning, prerequisites for use, the working environment, work arrangements, health-related

aspects, the external environment, maintenance and emergency preparedness. Requirements to environmental monitoring are listed in an appendix, which forms part of the regulations.

The above mentioned regulations are among others founded in the following most relevant Acts:

- Petroleum activities act
- Working environment act

Other Acts (to which the HSE regulations are pursuant)

- Pollution and waste
- Health personnel (in Norwegian only)

In addition to the regulations of the PSA as mentioned above, marine regulations may be relevant for a Mobile Offshore Drilling Unit (MODU). See more information about this at the end of this section.

This report is mainly based on the regulations under the PSA.

The regulations under the HSE authorities cover the field of health, safety and the environment (HSE), but note that this field encompasses safety, working environment, health, external environment and financial assets, the latter including production and transport regularity (operational availability) (see guideline for FR Sec. 2). Besides this the regulations shall cover all petroleum phases from the Concept phase to abandonment. With this approach, the regulations ensure a complete and comprehensive view on the work to obtain safe and prudent operation.

Guidelines for the HSE regulations include references to standards. The guidelines are not legally binding, but the regulations and the guidelines should be viewed in context to gain the best possible interpretation of the provisions and how they are to be met. The regulations set the performance requirements, whereas the Guidelines specify activities that will satisfy the requirements in the regulation. If, however, a company decides to implement another approach/specification than what is described in the Guidelines, this is acceptable, but the company must then generate evidence that the selected alternative method is just as good as the one described in the Guideline. Guidelines are issued for each of the five regulations.

In the guidelines to the Framework Regulations sec.18 on Documentation the terms “should” and “may” are used when reference is made to *recommended* solutions to fulfil the requirements of the regulations. In that connection these terms mean the following:

- **“Should”** means the authorities’ recommended manner of fulfilling the performance requirement. Alternative solutions with documented equivalents of functionality and quality can be employed without being submitted to the authorities for approval. This means that the requirement is considered to be fulfilled if a recommended solution is selected.

  However, the section also says that if an alternative solution is selected, one must be able to document that said fulfilment of the requirement is just as good as or better than the recommended solution. A “solution” here means an industry standard or recognized norm.

- **"May"** means an alternative, equivalent manner of fulfilling the function requirement, for example where the comments recommend using maritime norms as an alternative to a NORSOK standard.

For *requirements*, that are mandatory, the term *"shall"* is used:

- **"Shall"** directly conveys a requirement of law or regulations or the authorities' interpretation of requirements that allow for no other solutions, for example as regards whether an activity or equipment is encompassed by the scope of application of the regulations or not.

For more information about standards referred to in the regulations, see FR Sec. 8 about different types of standards and FR sec. 18 regarding application of the standards.

Interpretations

Interpretations are issued for each of the regulations. Application of performance based requirement may for some cases lead to different understanding or interpretation of requirement based on individuals' personal consideration, and in this case the interpretation documents will be useful. An interpretation is a statement from the authorities on how the legislation or provisions in the regulations should be understood and is thus guidance on how the party responsible may adhere to the regulations.

Interpretations refer generally to how to meet provisions in the regulations. Interpretations give an answer to how the legislation should be understood, and interpreting is done when dealing with concrete matters like applications for consent (AfC), exemptions etc

The guidelines and interpretations are available at: www.psa.no.

The purpose of these regulations is to:

a) "Further a high level as regards health, environment and safety in the petroleum activities,

b) Achieve a systematic implementation of measures to fulfil the requirements and reach the objectives set out in the legislation relating to health, environment and safety,

c) Further develop and improve the level as regards health, environment and safety".

(FR sec. 1 Purpose)

To whom are the regulations directed

The regulatory requirements are directed towards operators, licensees and all other parties who participate in the petroleum activities without being licensees or operators. "Other parties" may include owners and users of facilities/MODUs, contractor and sub-contractors (e.g. service providers, hired personnel, suppliers and drilling contractors) and employees. For more detail about responsibilities, see section 3.3.

The regulations under the PSA are:

- Mainly performance based with supplementary prescriptive requirements

  The performance based requirements include *common* requirements for all areas and *specific* requirements that relate to specific areas, e.g. requirements on design of drilling equipment etc. Performance based requirements indicate the desired level of HSE performance (i.e. results or achievements) without providing any specific solution/ practice (see Fact box 1). These requirements are to a large extent based on the specific needs of the players.

- Mainly risk-based (see Fact box 2)

  The HSE regulations emphasize the principle of risk reduction related to health safety and environmental protection (HSE). There is a strong focus on risk management in the regulations.

- Focussed on prevention of accidents

  The requirements support a preventive focus as they are directed towards activities and practices to avoid accidents.

- Based on the principle of "self-regulation"

  This means that it is the responsibility of the company (e.g. operator or contractor) itself to comply with the regulations (including predefined standards) and not the responsibility of the authority. This requires an active approach where the company needs to identify its own need for control based on relevant identified risks, and establish systematic and control measures to ensure compliance with the regulations.

- Multidisciplinary

  The structure of the regulations reflects the fact that their requirements are largely common or multidisciplinary and hence appear in just one place. Pertinent examples are the Framework Regulations Section 2 on scope and the Management Regulations Section 2 on barriers.

  In cases where a requirement does not apply across the entire scope of the regulations, this will be clear from the text and the context in each case; see the guidelines to the Framework Regulations Section 2.

- Regularly improved and updated

  Extensive work has since been pursued to harmonize regulations for offshore and land-based petroleum operations and to develop a regulatory regime which accords with the PSA's enlarged role. New revised regulations from 1. January 2011 makes a step forward here. See here for more information: http://www.ptil.no/news/new-hse-regulations-adopted-article6864-79.html

Fact box 1

Performance based vs. prescriptive regulations

Two approaches exist for regulating safe (should be understood as "HSE") activity in this sector – performance based (equal to the term "functional-based") or prescriptive based. These characteristics describe how the regulatory system is *structured.*

A performance-based regulation involves specifying the performance or function which is to be attained or maintained by the industry. The regulatory role here involves defining the safety standards which companies must meet and checking that they have the management systems which permit such compliance. Through a performance based regulation the companies are given a relatively high degree of freedom in selecting good solutions which fulfil the official requirements.

Interpretation of the desired performance levels defined in the regulations is not always clear or easy to understand. In this case the interpretation documents are useful. See more about these earlier in this section.

A prescriptive system is based on laws and regulations which set specific demands for structures, technical equipment and operations in order to prevent accidents and minimize hazards. The regulatory authorities thereby lay down the necessary requirements for HSE, and monitor that the companies comply with these.

The PSA states as follows:

"A trend has existed among safety regulators worldwide over the past 20-30 years to move their regimes towards a greater degree of functional-based regulation. This is because the prescriptive approach has often turned out to encourage a passive attitude among the companies. They wait for the regulator to inspect, identify errors or deficiencies and explain how these are to be corrected. As a result, the authorities become in some sense a guarantor that safety in the industry is adequate and take on a responsibility which should actually rest with the companies"

(http://www.ptil.no/news/from-prescription-to-performance-in-petroleum-supervision-article6696-79.html).

Fact box 2

Risk-based regulations

This characteristic of a regulatory system describe how requirements are given and shall be fulfilled within the regulatory system and is independent of the structure of the regulatory system.

In a risk-based regulation the regulatory requirements are based on a risk-based approach to management of health, safety and the environment. This means that the regulations must be seen in relation to the specific risks faced by the individual player, and that the player must;

- Systematically identify risks,
- Reduce risks to defined acceptance levels,
- Control risks,
- Use the identified risks as basis for current prioritizing and decision-making in the company.

The risk picture must be subject to regular updates. Safety and contingency measures must be commensurate with the risk in each individual activity. The higher the risk, the more effort is required and the more wide-ranging measures must be implemented.

The term risk is defined as the combination of probability and consequence (Norwegian definition: FR Sec. 9)

The design of the HSE regulations for the petroleum activities on the shelf emphasizes the development of unified regulations stipulated and enforced by the PSA, the Climate and Pollution Agency and the health authorities.

Tripartite cooperation, between operators, authorities and labour organisations, are necessary pre-requisites for preparing and fulfilling the regulations (see information about tripartite cooperation in the description of the PSA in section 2.3.2)

Access to regulations and user friendliness

Easy access to regulations and key information is a prerequisite for use of the regulations and compliance with regulatory requirements. The Norwegian Regulations, guidelines and the interpretation documents are made easily available in an electronic format on the homepage of the PSA. NORSOK standards are available through hyperlinks in the guidelines.

The documents are user-friendly with a standard format, use of hyperlinks to standards and cross-references (other sections or documents) and hyperlinks from the regulations to the relevant guidelines and interpretation document in the regulation.

In addition to this, different other information considered useful for companies involved in the petroleum activities are “Active provision of news and information and news”.

2.2.3 THE U.S. GoM REGULATIONS

Formal documents and legal basis

Statutes enacted by the U.S. Congress are in general codified as U.S. Codes (USC). Thus, the USC is the official text of an Act of Congress (Statute enacted by the U.S. Congress). Important for offshore drilling operations in GoM is the Outer Continental Shelf Lands Act (OSCLA), 43 USC Subchapter III, as well as the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) regarding environmental issues.

While Congress passes the laws that govern the United States, Congress has also authorized government agencies to create and enforce regulations in order to put those laws into effect.

The following agencies has a role in relation to drilling operations:

- Environmental Protection Agency (EPA)
- Mineral Management Services (MMS)
- U.S. Coast Guard (USCG)

For information about the Congress and Governing agencies, see section 2.3.3.

Code of Federal Regulations (CFR)

The Code of Federal Regulations (CFR) is the codification of the general and permanent rules and regulations in the U.S. The regulatory requirements in the U.S. are primarily initiated by statutes and promulgated by rulemaking and published in the Code of Federal Regulations (CFR).

The relevant codes for offshore drilling activities are listed Table 2-1.

Table 2-1 Relevant CFRs for offshore drilling operations

Code of Federal Regulations	Authority (Agency)	Subordinate to:	Act
30 CFR 250 "Oil and gas and sulphur operations in the Outer Continental Shelf"	Mineral Management Services (MMS)	Secretary of Interior	Outer Continental Shelf Lands Act (OCSLA)
33 CFR 140-147, "Outer Continental Shelf activities"	U.S. Coast Guard (USCG)	Secretary of Homeland Security (peacetime)	Outer Continental Shelf Lands Act (OCSLA)
46 CFR "Shipping" (specified later in this section)	U.S. Coast Guard (USCG)	Secretary of Homeland Security	The Homeland Security Act (HSA)
40 CFR "Protection of the environment"	Environmental Protection Agency (EPA)	Department of Interior	Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

CFRs are available on different web pages, e.g. here: http://www.gpoaccess.gov/cfr/

30 CFR 250 under MMS

Of particular interest for this report is 30 CFR 250 which regulates mineral exploration, development and production on the Outer Continental Shelf (OCS). The parts of the regulations relevant for this report include:

- Detailed technical requirements to equipment and operations
- Detailed requirements plans and applications which shall be submitted to MMS for approval,
- Requirements to pollution prevention
- Requirements to training
- Guidelines to MMS case handling and inspections

33 CFR 140-147 under USCG

Specific to the OCS, the 33 CFR 140-147 regulates the safety of life and property on OCS facilities and vessels engaged in OCS activities, and the marine environment. The parts of the regulations relevant for this report include:

- Personnel and workplace safety and health
- Design and Equipment
- Lifesaving appliances and fire-fighting equipment
- Operations and safety zones

46 CFR "Shipping" under USCG

In addition to the regulations covering the OCSLA, USCG also manages the maritime legislation through 46 CFR "Shipping". The CFRs affecting offshore drilling activities are:

46 CFR 4	Marine casualties and investigations.
46 CFR 10	Licensing of maritime personnel
46 CFR 15	Manning requirements
46 CFR 107	Inspections and Certification (Part of SUBCHAPTER I--MOBILE OFFSHORE DRILLING UNITS)
46 CFR 108	Design and Equipment (Part of SUBCHAPTER I-A--MOBILE OFFSHORE DRILLING UNITS)
46 CFR 109	Operations (Part of SUBCHAPTER I-A--MOBILE OFFSHORE DRILLING UNITS)
46 CFR 199	Lifesaving Systems for certain Inspected Vessels

For more information on which areas of offshore drilling activities MMS and USCG regulate, reference is made to section 2.3.3.

40 CFR "Protection of the environment" under EPA

The U.S. Environmental Protection Agency regulates through 40 CFR "Protection of the environment". The parts of the regulations relevant for this report include protection from significant risks to human health and the environment. Efforts to reduce environmental risk are based on the best available scientific information.

In addition to the CFRs, MMS may issue Notices to Lessees and Operators (NTLs) and ITLs. The MMS no longer issues Letters to Lessees and Operators (LTL's). All notices are now in the form of Notices to Lessees and Operators (NTL's).

NTLs

According to 30 CFR §250.103 a NTL shall *"clarify, supplement, or provide more detail about certain requirements. NTLs may also outline what you must provide as required information in your various submissions to MMS"*.

According to information available at the homepage of MMS, NTL's are *"formal documents that provide clarification, description, or interpretation of a regulation or OCS standard; provide guidelines on the implementation of a special lease stipulation or regional requirement; provide a better understanding of the scope and meaning of a regulation by explaining MMS interpretation of a requirement; or transmit administrative information such as current telephone listings and a change in MMS personnel or office address.*

None of these definitions states whether NTLs are mandatory or voluntary. This is not either explained in the separate NTLs which do not have one common place for this information.

The NTLs are not referred to directly in the CFRs, but are made available here:
http://www.gomr.mms.gov/homepg/regulate/regs/ntls/ntl_lst.html

ITLs

Information to Lessees and Operators (ITL's) are also formal documents that provide additional information and clarification, or interpretation of a regulation, OCS standard or regional requirement, or provide a better understanding of the scope and meaning of a regulation by explaining MMS interpretation of a requirement.

It is not stated whether these shall be treated as mandatory or voluntary.

The ITLs are not referred to directly in the CFRs, but are made available here:

http://www.gomr.mms.gov/homepg/regulate/regs/itls/itlindex.html

Standards

Sections of 30 CFR 250 partially or fully incorporates internationally accepted industry standards by reference (30 CFR §250.198). These must be adhered to and are considered part of the regulation.

In general the U.S. GoM regulations are:

- Prescriptive
- Not risk-based
- Complex as regards the structure, with several authorities, several formal documents and the formal documents are made available at different places.
- Not always clear with respect to use of NTLs and ITLs
- A shared responsibility between the operator and the authority

This is reflected throughout the different regulations e.g. through a large number of requirements reflecting an extended practice for issue of approvals by the authorities.

- Not always specific, and many requirements are general and not clear

2.3 REGULATORY REGIMES

2.3.1 SUMMARY OF DIFFERENCES

- In Norway authority for the resource management is split from authorities for the HSE management, while in the U.S. both are handled within the same authority (as per April 2010).
- In both countries there are various authorities having different responsibilities. In Norway the PSA has the coordinating role in the development and supervision of regulations. In the U.S. this responsibility is shared between the different authorities.

2.3.2 THE NORWEGIAN REGULATORY REGIME

Organisation of the Norwegian Petroleum sector

The organisation of the Norwegian petroleum sector is illustrated in the figure below.

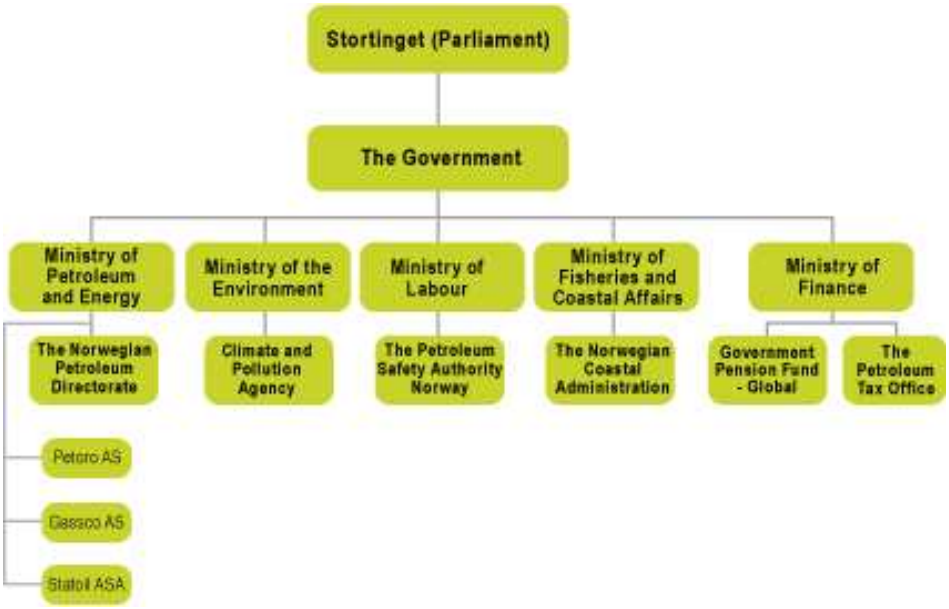

Figure 2-2 The organisation of the petroleum sector in Norway.

Stortinget (the Norwegian parliament), establishes the framework for the Norwegian petroleum activities. Matters of great public importance must be discussed by parliament, and it also supervises the Government and the public administration.

The Government holds the executive power over petroleum policy and is responsible towards the parliament for this policy. In applying the policy, the government is supported by the ministries and subordinate directorates and agencies as illustrated in the figure below.

The responsibility for executing the various roles within the petroleum policy is shared as follows:

- *The Ministry of Petroleum and Energy:*
  – responsible for resource management and for the sector as a whole
- *The Ministry of Labour:*
  – responsible for health, the working environment and safety
- *The Ministry of Finance:*
  – responsible for state revenues
- *The Ministry of Fisheries and Coastal Affairs:*
  – responsible for oil spill contingency measures
- *The Ministry of the Environment:*
  – responsible for the external environment.

Reference: The Fact Book 2010 available here: www.npd.no

The authorities and organisations which have responsibilities in relation to drilling operations and major safety and environmental risks include the Petroleum Safety Authority (PSA), the Climate and Pollution Agency (Klif), The Norwegian Coastal Administration - NCA and the Joint Rescue Coordination Centre – JRCC major safety and environmental risks. There are some additional authorities which has a role in follow up within the area of work environment, safety and health, but their responsibilities do not relate to major risks, hence they are not covered in this report.

The PSA, the Klif, the NCA and the JRCC are further described below.

The JRCC is not any authority but is mentioned here due to its important role in rescue services.

The NPD does not have any role within HSE management, but it is mentioned here to illustrate the entire Norwegian regulatory regime within the petroleum sector as basis for a comparison with the U.S. regulations.

The Petroleum Safety Authority, PSA

The Petroleum Safety Authority (PSA) is the regulatory authority for technical and operational safety, including emergency preparedness, and for the working environment. PSAs regulatory role covers all phases of the industry, from planning and design through construction and operation to possible ultimate removal.

The PSA has been delegated the authority to stipulate regulations, supervise compliance, and follow up to ensure that the players in the petroleum activities maintain high levels of health, environment, safety and emergency preparedness (see the definition of HSE in section 1.5).

This includes supervision of the HSE management system which is established pursuant to the petroleum HSE regulations and makes the decisions necessary to fulfil provisions on requirements to the administrative parts of the management systems, stipulated by or pursuant to these regulations. This is done in co-operation with the Climate and Pollution Agency (Klif), the Norwegian Board of Health Supervision or the one they authorise within their areas of responsibility. However, it is the PSA that makes the decisions necessary fulfil provisions on requirements to the administrative parts of the management systems (FR Sec. 13). The PSA has a coordinating role in the development of supervision of the petroleum regulations. Agreements for the coordination have been established between the PSA and among others Klif to define responsibilities.

The responsibility of Klif is described below. Other authorities for the HSE like The Norwegian Board of Health Supervision are not covered in this report as the health aspect is outside the scope of work for the project.

The supervisory function of the PSA and its effort is characterized by:

- **A number of supervisory activities**

  These activities collectively give the PSA a basis for deciding whether companies are fulfilling their responsibility to operate acceptably in all phases of the industry. These activities include management system audits, verifications, investigations, consents, meetings with the industry, surveys, studies, professional seminars, development of regulations etc.

  (http://www.ptil.no/audit-reports/category156.html and http://www.ptil.no/news/from-prescription-to-performance-in-petroleum-supervision-article6696-79.html)

- **Focus on management system performance** The focus is on the operating companies' own activity plans (management system activities of any party involved in petroleum activities) and their own planned audits. The companies' HSE management performance and practices will indicate the level of the companies' control with the relevant risks, their ability to reach goals and the degree of compliance with the regulatory requirement

  (http://www.ptil.no/audit-reports/category156.html)

- **Risk-based approach to audits**
  It's a regulatory principle that audits should be system-oriented and risk-based

  (http://www.ptil.no/role-and-area-of-responsibility/category165.html)

- **Focus on actual circumstances**
  Through measurements, testing and inspection they check if the actual circumstances conform with regulatory and management system requirements

  (http://www.ptil.no/audit-reports/category156.html)

- **Active provision of news and information and news**
  The Petroleum Safety Authority makes use of its website for communication concerning

various HSE activities, e.g. results from audit and investigations, reports, trends and statistics focus on accidents, PSAs priority areas etc. This makes it possible to highlight activities and priority areas. At the same time, publication on the Internet makes it easier for companies to utilize information from the PSA to facilitate learning and transfer of experience.

The information to be made available includes audit reports (only summaries in English), investigation reports, notifications of orders, brief consent reports, reports of Acknowledgments of Compliance (AoC) and identical letters to the industry (audit-related)

The government has given the PSA the duty to provide information and advice to the players in the industry, establish appropriate collaborative relationships with other HSE regulators nationally and internationally, and contribute actively to a transfer of knowledge from the HSE area to society in general.

(http://www.ptil.no/role-and-area-of-responsibility/category165.html) and
http://www.ptil.no/supervision/supervisory-activities-on-the-web-article350-88.html

- **International Collaboration with foreign safety regulators**
  The purpose of the collaboration is to learn from others regulators. PSA is active and agenda-setting participants in many international safety-related forums today.

  (http://www.ptil.no/international-collaboration/category169.html).

- **A continuous dialogue between the PSA and the players**
  It is PSAs policy to use dialogues as the main instrument to influence decisions/actions. If a dialogue does not lead to improvement, notice of orders, and then orders will be given. In serious cases where safety is endangered, an activity can be temporarily stopped. The authorities can also file charges with the police and impose fines.

  (http://www.ptil.no/audit-reports/category156.html)

- **A close and open dialogue with the parties involved in the petroleum industry**
  There is a culture characterized by openness and a close dialogue between the involved parties. A collaboration is established between employers, unions and government as well as workers with the purpose to improve the companies' HSE management systems and practices. Participation is an important corner-stone in efforts to establish and develop a high level of HSE in the petroleum industry.

  The PSA chairs two key tripartite arenas involving employers, unions and government: the Safety Forum and the Regulatory Forum:

  - *The Regulatory Forum*
    The Regulatory Forum shall in dialogue with the parties facilitate:

    - Information, discussion, consultation and, if relevant, feedback on the work on development and maintenance of framework documents for the petroleum activities, such as regulatory strategy and regulatory work, adaptation to the EU/EEA regulations, other international frameworks,

norms, etc. related to health, safety and the environment in the petroleum industry.

- Information and discussion regarding the practical implementation and use of the HSE regulations.
- Exchange of viewpoints relating to contents and experiences in connection with implementation of the individual regulatory work.

The Regulatory Forum does not have any governing role, but it is an important forum for discussions and advisory within the field of HSE.

(http://www.ptil.no/regulatory-forum/category168.html)

- *The Safety Forum*
  The Safety Forum is the central arena for cooperation among the parties in the industry and the authorities as regards health, safety and environment in the petroleum activities on the Norwegian shelf and on land. The main objectives of the Safety Forum are
  - being represented by managers, HSE personnel and key decision-makers among the parties in the industry and the Petroleum Safety Authority Norway, and with the Ministry of Labour and Social Inclusion being an active observer
  - facilitating and stimulating cooperation and debate on key HSE challenges in the petroleum activities, both offshore and at onshore facilities.
  - being a consultation arena for, a driving force behind and an initiator of strategic HSE projects and processes within the framework of the PSA's area of responsibility
  - being a driving force behind the dissemination of information and knowledge regarding HSE and the development and establishment of positive HSE cultures and practices between the parties and the authorities according to Section 1 of the Working Environment Act.

  (http://www.ptil.no/safety-forum/category167.html)

In addition to these forums, the PSA participates as member or observer in a number of other multi-party fora. The *RVK project* and *Working together for Safety* (Samarbeid for Sikkerhet) are two such examples.

- *The RVK project*

  RVK (Regelverkskompetanse) is a training program for the petroleum industry providing courses in regulations. RVK is a joint project between authorities, employers and employees aiming at increasing the knowledge and awareness around the HSE regulations. The RVK project is administered by Handelshøyskolen BI.

(http://www.rvk.no/index.php) and (http://www.ptil.no/regulations/category87.html)

- *Working together for Safety*

  The Working together for Safety (Samarbeid for Sikkerhet) project is one of the most extensive collaboration projects initiated within health, safety and the environment (HSE) in the oil and gas industry.

  The project concentrates on safety on offshore installations, onshore installations and on board vessels on the Shelf, and focuses on all conditions that affect the nature of the work and framework conditions. This entails, among other things, focusing on corporate culture, structure, organisation and management.

  The project will contribute towards:

  - Improving safety in the oil and gas industry offshore
  - Reducing the risk of personal injury and major accidents
  - Improving the employees' and their family's trust in the industry
  - Strengthening trust and cooperation between the players in the industry
  - Improving the reputation of the industry

  The work takes place through recommendations to the industry. The project communicates through text, films, gatherings and seminars with a view to document and exchange best practice in the industry.

  (www.samarbeidforsikkerhet.no)

The PSA has identified priority areas where action will have the biggest impact, and where special attention is needed if Norway is to fulfill its ambition of being a world leader in petroleum-related HSE.

Reference: Presentations prepared by the PSA and other information available at www.psa.no.

The Climate and Pollution Agency, Klif

The Climate and Pollution Agency (Klif) (the former Norwegian Pollution Control Authority) is a directorate under the Norwegian Ministry of the Environment. Klif implements government policy on pollution, act as guides, guardians and a driving force for a better environment. The most important fields of work include climate change, chemicals, water and the marine environment, waste management, air quality and noise.

Klif's functions and roles:

- Exercise regulatory authority and carry out inspections and environmental audits

- Monitor the extent of pollution from oil and gas enterprises on the Norwegian continental shelf
- Take measures to combat operational discharges of oil, acute spills of oil and chemicals
- Instruct and guide the County Governors' environmental departments
- Provide expert advice and promote key environmental initiatives
- Participate in international environmental and development cooperation

For more information, see here: www.klif.no

The Norwegian Coastal Administration - NCA

The Norwegian Coastal Administration (NCA) is a Governmental agency under the Ministry of Fisheries and Coastal Affairs. NCS's task is to safeguard and develop the coastline for all users. They shall contribute to secure vessel traffic and good accessibility along the coast as well as a good, national preparedness against acute pollution.

Since 1st January 2003 the NCA is delegated the enforcement of parts of the Pollution Control Act including the national preparedness against acute pollution

The main responsibilities for NCA:

- Provide for the necessary emergency response system to deal with major incidents of acute pollution.
- Potentially assume wholly or partly command of efforts to deal with the accident in the event of major incidents involving acute pollution or a risk of acute pollution. Only if the responsible party does not manage the situation.
- Inspection and control measures relating to pollution and waste.

The NCA has the overall responsibility for pollution contingency plans and for coordinating, organizing and managing the state pollution contingency within Norway and the Norwegian economic zone.

For more information, see section 6 and www.kystverket.no

Joint Rescue Coordination Centre – JRCC

The Rescue and Emergency Planning Department under the Ministry of Justice has been given responsibility for the administrative coordination of the land, sea and air rescue service. Joint Rescue Coordination Centres (JRCC) (Sothern and Northern) has been delegated the execution of the coordinating rescue service together with the secondary local rescue coordinating centres that are placed under the country's police districts.

The JRCC tasks relevant to drilling are to:

- Coordinate rescue operations
- Receive emergency calls and quickly assess the situation

- Take action and lead the subsequent search and rescue operation.

The intention of the JRCC is to mobilise all available resources in Norway, whether they belong to the national, county or local governments, are private or volunteered to cooperarte in the government-coordinated rescue service under the supervision of the JRCC.

For more information, see section 6 and www.hovedredningssentralen.no

Norwegian Petroleum Directorate, NPD

The objective of the Norwegian Petroleum Directorate is to contribute to creating the greatest possible values for society from the oil and gas activities by means of prudent resource management based on safety, emergency preparedness and safeguarding of the external environment.

In order to make the most efficient contribution to this, the NPD must perform four functions:

- The NPD is to be an adviser to the Ministry of Petroleum and Energy through its professional integrity and interdisciplinary expertise.
- The NPD has a national responsibility for data from the Norwegian continental shelf. The NPD's data, overview and analyses constitute a crucial factual basis on which the activities are founded.
- The NPD shall be a driving force for realising the resource potential by emphasising long-term solutions, upside opportunities, economies of scale and joint operations, as well as ensuring that time-critical resources are not lost.
- In cooperation with other authorities, the NPD is to ensure comprehensive follow-up of the petroleum activities.

The NPD does not have any role within the area of safety, health and environment.

(http://www.npd.no/en/About-us/)

2.3.3 THE U.S. GoM REGULATORY REGIME

Organisation of the U.S. GoM regime

The U.S. regulatory regime is illustrated in Figure 2-1.

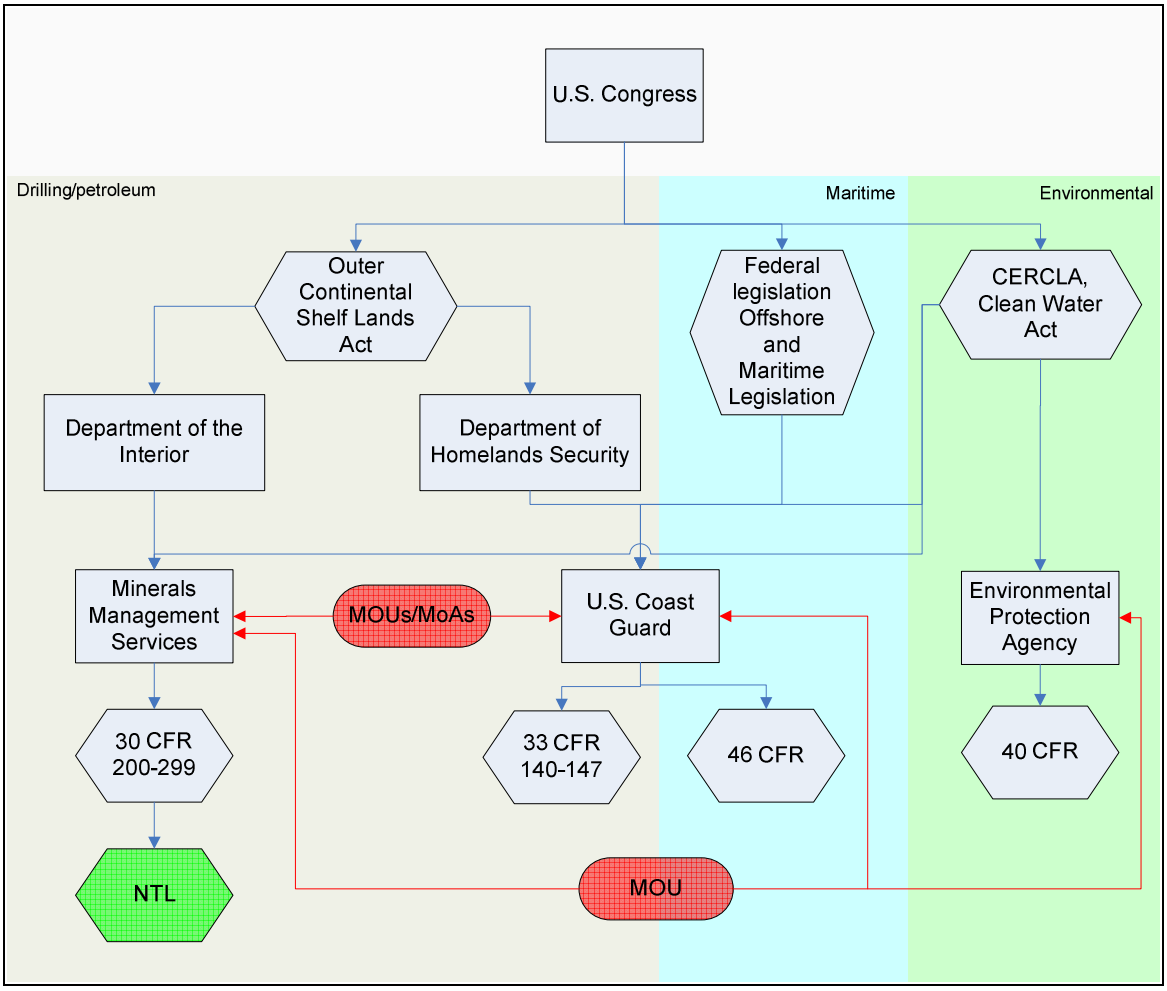

Figure 2-1 Overview of relevant laws, departments, agencies, regulations and their interfaces. The hexagons are laws/regulations while the rectangles are regulatory bodies.

The Minerals Management Service (MMS) and the United States Coast Guard (USCG) are the primary authorities regulating offshore drilling in GoM, but the U.S. Environmental Protection Agency (EPA) also has specific areas of responsibility. The overlapping responsibilities between these agencies are covered by agreements, i.e. MoUs (Memorandum of Agreement) and MoAs (Memorandum of Agreement). The three agencies and the agreements regulating the interfaces between them are described below.

Minerals Management Service, MMS

The Minerals Management Service (MMS) is an agency within the U.S. Department of the Interior (DOI) that manages the U.S. energy and mineral resources. Through its Offshore Energy and Minerals Management program, MMS regulates the activities on over 8,000 leases and more than 3,700 oil and gas facilities on the OCS.

MMS is responsible for regulating oil, gas, and sulphur exploration, development, and production operations on the Outer Continental Shelf (OCS) through the OCSLA. This responsibility encompasses several objectives, 30 CFR §250.101:

- To make resources available to meet the Nation's energy needs,
- To balance orderly energy resource development with protection of the human, marine, and coastal environments,
- To ensure the public receives a fair and equitable return on the resources of the OCS,
- To preserve and maintain free enterprise competition, and
- To minimize or eliminate conflicts between the exploration, development, and production of oil and natural gas and the recovery of other resources.

The agency has implemented a process for managing oil and gas development consisting of the following stages:

- Preparing a 5 year oil and gas development program
- Planning for and holding lease sales
- Approving a company’s Exploration Plan
- Approving a company’s Development and Production Plan

Compliance with safety and environmental protection regulations is ensured through inspections of OCS facilities and operations in addition to the approbation activities listed above.

United States Coast Guard, USCG

The United States Coast Guard (USCG), within the Department of Homeland Security (DHS), is a military, multi-mission, maritime service. Its core roles are to protect the public, the environment, and U.S. economic and security interests in any maritime region in which those interests may be at risk, including international waters and America's coasts, ports, and inland waterways.

“The Coast Guard shall enforce or assist in the enforcement of all applicable Federal laws on, under, and over the high seas and waters subject to the jurisdiction of the United States; shall engage in maritime air surveillance or interdiction to enforce or assist in the enforcement of the laws of the United States; shall administer laws and promulgate and enforce regulations for the promotion of safety of life and property on and under the high seas and waters subject to the jurisdiction of the United States covering all matters not specifically delegated by law to some other executive department…”, 14 USC 2 – Sec. 2 “*Primary Duties*”.

Thus, the Coast Guard fundamental roles include:

- Maritime Safety
- Maritime Security
- Maritime Mobility
- National Defence
- Protection of Natural Resources.

Specific to the OCS, the USCG regulates the safety of life and property on OCS facilities and vessels engaged in OCS activities, and the safety of navigation. In addition, the USCG is responsible for promoting workplace safety and health by enforcing requirements related to personnel, workplace activities, and conditions and equipment on the OCS. The USCG is also responsible for security regulations on OCS facilities, as specified under the Maritime Transportation Security Act (MTSA), and has selected duties for regulating deepwater ports as enumerated in the Deepwater Ports Act (DPA), as amended.

US Environmental Protection Agency, EPA

The EPA is an independent agency reporting directly to the President and the primary agency responsible for regulating certain environmental activities on the OCS, specifically concerning with air and water quality.

The 1990 amendments to the Clean Air Act (CAA) transferred jurisdiction from the DOI to the EPA to establish requirements to control air pollution from outer continental shelf sources in order to attain and maintain Federal and State ambient air quality standards for all OCS areas, except for the Gulf of Mexico west of 87.5 degrees longitude. For those OCS areas subject to EPA jurisdiction, regulations for sources located within 25 miles of a State's seaward boundary must be the same as those applied in the nearest onshore area. For areas more than 25 miles from the State's seaward boundary, general EPA provisions apply.

The Clean Water Act (CWA) of 1977 is the primary law governing the discharge of pollutants into all U.S. surface waters. Under this law, the EPA requires a National Pollutant Discharge Elimination System (NPDES) permit to be obtained by owner/operators, before any pollutant is released.

Under this law, the EPA requires that a National Pollutant Discharge Elimination System (NPDES) permit be obtained by owner/operators, setting requirements to discharge from OCS oil & gas operations has been issued by EPA before any pollutant is released.

The mission of EPA is to protect human health and to safeguard the natural environment: air, water and land, upon which life depends.

EPA's purpose is to ensure that:

- Americans are protected from significant risks to human health and the environment,
- National efforts to reduce environmental risk are based on the best available scientific information

- Federal laws protecting human health and the environment are enforced fairly and effectively,
- All aspects of environmental protection are an integral consideration in U.S. policies,
- All parts of society have access to accurate information sufficient to effectively participate in managing human health and environmental risks,
- Environmental protection contributes to making communities and ecosystems diverse, sustainable and economically productive;
- The United States plays a leadership role in working with other nations to protect the global environment.

References: 40 CFR part 55, http://www.mms.gov/eppd/compliance/caa/epa.htm

USCG & MMS Common interest

The responsibilities of the USCG and the MMS are based upon their September 30, 2004 Memorandum of Understanding (MoU) concerning " *…joint or overlapping jurisdiction related to OCS facilities and OCS activities*" (MoU MMS/USCG 2004). Guidance to each agency's role and shared responsibilities are given in Memorandum of Agreement (MoAs) developed under the terms in the MoU.

Four MoAs have been entered by MMS and USCG clarifying agency responsibilities for MODUs within the following areas:

- Civil penalties
- Oil spill financial responsibilities
- Oil spill preparedness and response planning
- Oil spill response
- Accident investigations
- Offshore facility system/sub-system responsibility

For the latter, a detailed matrix showing the *lead agency* for MODU systems/sub-systems can be found in MMS/USCG MoA OCS-01, Annex 1. USCG requirements are predominant in areas of work place safety, marine system and non-drilling or process related systems MODUs (MODUs), 33 CFR §146.202.

MMS, USCG & EPA MoU

EPA signed a MoU February 17, 1994 with MMS, USCG and the Office of Pipeline Safety. The MoU concludes that responsibilities associated with oil-spill prevention and control, response planning, and response equipment inspection for offshore facilities are as follows:

1) The MMS is responsible for offshore facilities, including pipelines located seaward of the coastline, except for deepwater ports and associated seaward pipelines

2) The EPA is responsible for non-transportation-related offshore facilities located landward of the coast line.

3) The U.S. Coast Guard and the Research and Special Programs Administration handle vessels, deepwater ports, and the marine transfer components of transportation-related onshore facilities, including some inland port areas.

On February 4, 1997, an MOU was signed to establish and clarify the jurisdictional responsibilities for oil spill prevention and facility response planning for offshore facilities under the OPA.

The MOU returned to EPA's jurisdiction all non-transportation-related facilities located in and along the Great Lakes, rivers, coastal wetlands, and Gulf Coast Barrier Islands, landward of the coastline under the Submerged Lands Act.

Transportation-related offshore facilities, including pipelines located landward of the coastline, were re-delegated to DOT OPS from MMS. MMS retains jurisdiction over offshore facilities, including pipelines located seaward of the coastline, except for deepwater ports and associated seaward pipelines delegated by EO 12777 to DOT.

3 MANAGEMENT REQUIREMENTS

3.1 INTRODUCTION

This section covers differences in the management systems requirements between Norway and the U.S. Important management areas related to management systems in the Norwegian regulations are identified and compared with the relevant management areas in the U.S. regulations.

3.2 MANAGEMENT SYSTEM

In summary, the Norwegian regulations establish requirements to establish and maintain documented HSE management systems while in the U.S. adoption of a Safety and Environment Management Program (SEMP) is voluntary.

In Norway, the party responsible (operator, contractor, supplier etc) shall establish, follow up and further develop a management system in order to ensure compliance with requirements contained in the legislation relating to safety and the environment (FR §13). Based on this requirement, the duty "to-see-to-it" (FR §5) and the requirement to follow up other participants (FR §14), it is also necessary for the party responsible to ensure consistence between own and other participants HSE management systems. This will be ensured trough establishment of bridging documents. See the guidelines to the Frame Regulations for further explanations

The term "Further develop" means that the management system shall be subject to continuous improvement to ensure it is kept updated based on the external changes (e.g. in regulations) and changes in the organisation (e.g. existing risk picture, manning and activities).

In the U.S., there is no regulatory requirement on establishment of a management system for parties involved in offshore drilling operations. However, there are recommendations to establish a safety and environmental management program. See Fact box 3.

Fact box 3

SEMP and SEMS

MMS has encouraged the voluntary adoption by lessees and operators of API Recommended Practice 75 *"Development of a Safety and Environmental Management Program (SEMP)"* for Outer Continental Shelf Operations and Facilities which cover minor parts of an entire management system related to safety and environment. However, this is only recommended and not mandatory. Hence it is up to the separate operators to adapt the recommended practice.

It should also be mentioned that on June 17. 2009, the MMS published a proposed rule to require operators to develop and implement a Safety and Environmental Management System (SEMS) to address oil and gas operations in the Outer Continental Shelf The SEMS would consist of four elements:

- Hazards Analysis,

- Management of Change,
- Operating Procedures, and
- Mechanical Integrity

SEMS has been proposed as a regulatory requirement and would replace the current SEMP recommended concept and describe management commitment to safety and the environment, as well as policies and procedures to assure safety and environmental protection for OCS operations (including operations by contractors and subcontractors. The proposed regulations can be found at:
http://www.mms.gov/federalregister/PDFs/74FR28639.pdf

3.3 RESPONSIBILITIES

In summary, the Norwegian HSE regulations specifically states to whom the HSE requirements are directed (e.g. operator, licensee, contractor etc.). In the U.S. the responsibility for adherence to requirements within specific areas is defined in various parts of the individual regulations.

In Norway the operator shall see to it that all parties carrying out work on its behalf (e.g. contractor) complies with regulatory HSE requirements (the duty “to-see-to-it”). No similar requirement exists in the U.S..

In Norway, the regulations specifically states once to whom (e.g. operator, licensee, contractor etc) the HSE requirements are directed (FR Sec. 5).

The regulation specifies that the operator and other parties involved in the petroleum activities (contractors, suppliers, owner and users of facilities and employees) are responsible according to the HSE regulations and that the party responsible shall ensure compliance with the regulations. The operator shall “see-to-it” (i.e. ensure) that everyone carrying out work for him, either personally, by employees or contractors shall comply with requirements within the same regulations. (This duty is mentioned as the duty “to-see-to-it”). This duty also applies to subcontractors contacting other parties.

The responsible party shall follow up with verifications and audits ensuring that the participants comply with the requirements during conduct of the work.

Another aspect of the regulations is that the responsible shall document that the responsibility and authority shall be defined at all times and the necessary steering documents shall be prepared, and the necessary reporting lines shall be established (MR Sec. 3).

There is a regulatory requirement to appoint safety delegates with the responsibility to monitor the situation of hazards and with the authority to stop work operations, whenever needed (FR Sec. 46).

In the U.S., the responsibility for adherence to requirements within specific areas is defined in various parts of the individual regulations.

For example, an operator might find requirements on a specific area in several of the CFRs, under various regulators, e.g. environmental requirements are found in both 30 CFR under the MMS and in 40 CFR under EPA, and emergency preparedness are found in several of the CFRs, under both MMS, EPA and USCG. Consequently an operator (or other participants) must identify requirements related to a specific area in more than one regulation. This implies it might be complicated for the operator to identity the relevant regulator requirements.

For example, responsibilities are addressed within 30 CFR 250 under MMS, 30 CFR §250.105, 30 CFR §250.400, 33 CFR 146 and USCG as "You" or "The Person in Charge", but there is no requirement in place in the U.S. regulations that match the Norwegian requirements for the duty "to-see-to-it".

3.4 RISK ANALYSES, RISK MANAGEMENT AND ACCEPTANCE CRITERIA

In summary, in contrast to the Norwegian regulations, the U.S. regulations are not risk-based, see Fact box 2. It has been concluded that there are not any requirements on risk management for drilling installations and operations in the regulations. Furthermore, in general there are no requirements in place for operators or others participants in the offshore drilling activities to establish acceptance criteria.

In Norway, there are requirements on carrying out all necessary risk analysis and to handle risks connected to, among others, all planned drilling and well activities, and to know the effect of the total risk picture on the facility. The analyses shall be used to set conditions for operation and to classify areas, systems and equipment with respect to the identified risk.

Analysis of major risk is given extra attention and a separate section in the regulation addresses the requirement on major risk assessment (MR Sec. 14).

Requirements related to quantitative risk analyses and emergency preparedness analyses are presented in MR Sec. 15 and 16. Quantitative risk analyses related to safety and environment shall be carried out to provide a balanced and as comprehensive picture as possible of the risk, identifying hazards and accident potentials as well as carry out modelling of accident sequences and consequences. NORSOK Z-013 *"Risk and emergency preparedness analysis"* is the standard used for planning, execution and use of risk and emergency preparedness analysis in Norway. This standard is referenced in guidelines to MR Sec. 15 and 16.

All operators shall set acceptance criteria for major accident risk and environmental risk. The acceptance criteria shall be set for the personnel on the facility as a whole, the loss of main safety functions, pollution from the facility and damage done to third party (MR Sec. 6).

In the U.S., there is a general focus on risks and risk control. However, there is no specific regulatory requirement to the operator on performing risk analyses, apart from Environmental Impact Assessment (EIA). The EIA is a project-specific analysis that assesses the potential direct and indirect environmental impacts to offshore and onshore resources that could be affected by the proposed activities.

3.5 BARRIERS

In summary, there are no general requirements in place in the U.S. regulations for systematically establishing barriers with the same meaning as in the Norwegian regulations where technical, operational or organisational barriers are included, see Fact box 4.

The Norwegian regulation requires that barriers have been established, and that performance requirements shall be defined with respect to the defined technical, operational or organisational elements.

In Norway, there is an overall requirement in the regulations (MR Sec. 1 and 2) that the operator shall establish barriers and know the functions the barriers are intended to fulfil. Furthermore, the operator must know the performance requirements related to the barriers that have been defined in respect of the technical, operational or organisational elements which are necessary for the individual barrier to be effective. Those barriers shall be established to reduce the probability that any failures and situations of hazard and accident will develop further to limit possible harm and nuisance. The barriers shall also be tested, for further information, see section 4 in this report (MR Sec. 2).

This means that these should be formulated such that they contribute to giving all involved parties a common understanding of the basis for the requirements for the individual barriers, including what connection there is between the risk and hazard assessments and the requirements on and to the barriers.

It shall be known which barriers are not functioning or have been impaired and the responsible for the operation of a facility, shall establish indicators to monitor changes and trends in major accident risk.

The party responsible shall take necessary actions to correct or compensate for missing or impaired barriers.

In the U.S., DNV has not found any general requirements in place for organisational and operational barriers as equivalent to the Norwegian regulations (MR Sec. 1). However, the intention is met for some cases, especially for technical barriers where specific requirements are addressed for equipment is addressed in section 4.3.

Fact box 4

Barriers

The term "barrier" is not defined in the strict sense used in the regulations. The term is used in a broader sense with slightly varied meanings:

- Barrier is used synonymously with safety or emergency preparedness system or function
- In some cases, the barrier term refers to a larger function.

It has also been specified that barriers include operational and organizational measures, not just technical measures as described in the examples at http://www.ptil.no/getfile.php/PDF/requirements%20to%20barrier%20reporting%20ver11.pdf

The ISO 17776 definition of barriers is:

"…measure which reduces the probability of realizing a hazard's potential for harm and which reduces its consequence

NOTE Barriers may be physical (materials, protective devices, shields, segregation, etc.) or non-physical (procedures, inspection, training, drills, etc.)."

It emerges that this definition correlates with the description of barriers in Sec. 1 of the Management Regulations.

3.6 COMPETENCE AND TRAINING – GENERAL AND FOR PERSONNEL RESPONSIBLE FOR WELL CONTROL/WELL DESIGN

In summary, there is a general requirement in Norway that there shall be adequate competence in all phases of petroleum activities. In the U.S. there is competence requirements related to a few critical activities or operations. However, DNV has not found any overall requirements to competence in drilling operations.

In Norway, there is a general requirement in the regulations that adequate competence shall be ensured for all phases of the petroleum activities and that at all times personnel shall have the competence necessary to carry out activities safely (FR Sec. 10). The operator shall ensure that contractors and suppliers are qualified and competent (FR Sec. 14).

Furthermore, employees shall be given necessary safety training (AR Sec. 20) and be capable of handling situations of hazard and accident (AR Sec. 19).

This implies that all relevant personnel in addition to professional competence shall have necessary system knowledge and HSE competence, including e.g. knowledge of hazard and risk reduction, barriers, and safety culture. This includes competence for all positions and roles, e.g. auditors, management system administrator, maintenance personnel etc. (MR Sec. 11).

The regulations require establishment of competence requirements, that training is carried out based on identified needs, and that effectiveness of the training is evaluated.

The regulations focus on competence and training requirements based on risk with functions or engagement. The regulations are risk-based because the responsible party has to identify potential failures or mistakes by those performing tasks that can lead to major accident/serious HSE consequences. Competence criteria are based on this and also the function of reducing the probability of failure and hazards developing further (MR Sec. 11).

The requirements on training needs are based on and are adjusted when new work tasks, new equipment/technology etc are introduced. Criteria shall be established as to what is to be deemed necessary training (AR Sec. 20).

In regards to drilling and well activities (AR Sec. 19), NORSOK D-010 *"Well integrity in drilling and well operations"*, is referred to in order to fulfil the PSA requirements. However, this is a recommended, not mandatory, standard. ISO 15544 *"Petroleum and natural gas industries -- Offshore production installations -- Requirements and guidelines for emergency response"* for requirements and guidelines for emergency response and OLF's Guidelines for safety and emergency preparedness training No. 002 revision 16 are referred to in order to fulfil the requirements for emergency preparedness and safety. These are also voluntary.

In the U.S., there is competence requirements related to critical activities or operations. The CFR strongly emphasise the need for competence in Well Control and Petroleum Production. The USCG requires vessels to have competent personnel in certain Maritime skills, such as lifeboatman or OIM, Ballast Control Room operator etc. In order to be assigned one of these positions, a USCG training course has to be completed and a license issued.

In the CFR training requirements, there is emphasise on verified training programs, retention of knowledge and maintaining of understanding as well as periodic training in regards to well control or production safety practices (ref 30 CFR ch. II 250.1501 - 1510). The CFR also gives detailed requirements for spill response training courses, (ref 30 CFR 254.41) and spill response exercises (ref 30 CFR 254.42), and required training for H2S preparedness in case a prospect has been deemed "H2S Unkown" or "H2S Present", (ref 30 CFR 250.490 g.).

3.7 MONITORING OF PERFORMANCE

In summary, in contrast to the Norwegian regulations there are no regulatory requirements on the operator in the U.S. to conduct management system audits. In the U.S. the inspections is to a larger degree the responsibility of the authorities.

In Norway, the party responsible shall ensure that data are collected and used to monitor and control technical, operational and organizational aspects in order to ensure regulatory compliance and improvement of own and other participants' HSE performance. This includes i.a. management system audits, inspections and measurements (FR Sec. 14 and 15, MR Sec. 18 and 21). Furthermore, corrective and preventive actions, including improvement of systems and equipment shall be identified and implemented (MR Sec. 22).

Learning from events is a focus in the regulation. Non-conformities shall be immediately handled, their causes shall be identified and corrective actions shall be implemented to prevent recurrence. The actions shall be followed up to ensure effectiveness of the implemented measures.

The regulation requires that monitoring activities are reflecting the risk picture, with special focus on major risks.

In the U.S., there are some requirements on the operator that inspections for specific equipment/systems (e.g. drilling and production facilities) shall be carried out and that the results

shall be recorded (e.g. 30 CFR 250.130, 30 CFR 250.301 inspection of facilities). In addition, several inspections activities are carried out by the authorities.

Section 3.2 in this report states that there is no requirement on establishing a management system; hence, there are no regulatory requirements on the operator to conduct internal management system audits.

3.8 EMERGENCY PREPAREDNESS

In summary, the Norwegian emergency preparedness for personnel is risk-based. Apart from that, no major differences have been found between the Norwegian and the U.S. for emergency preparedness for personnel.

In Norway, the regulation (AR Sec. 64) has requirements for the operator or the party responsible for the operation of a facility to prepare a strategy for emergency preparedness against situations of hazard and accident. The emergency preparedness shall be established on the basis of results from a set of defined analysis with regards to safety and environment.

The operators shall cooperate with operators of other production licences on the emergency preparedness against acute pollution. Regions with common emergency preparedness plans and common emergency preparedness resources shall be established. The Climate and Pollution Agency may by individual decisions stipulate more detailed requirements with regard to regions.

The operator shall to the extent necessary co-operate with operators of other production licences to ensure necessary emergency preparedness in the areas of health, working environment and safety. The Petroleum Safety Authority may under certain circumstances order and stipulate conditions for such cooperation. This will include an order to the effect that the financing thereof shall be a collective responsibility.

When using vessels and mobile facilities registered in a national shipping register, the operator shall coordinate its own emergency preparedness plans and those of the contractors (AR Sec. 65).

Furthermore, there shall be a robust emergency preparedness organisation to be capable of handling situations of hazard and accident effectively (AR Sec. 66) and emergency preparedness plans shall be prepared which at all times describe the emergency preparedness and contain action plans in respect of the defined situations of hazard and accident (AR Sec. 67) .

The party responsible shall ensure that necessary actions are taken as soon as possible in the event of situations of hazard and accident so that (AR Sec. 68):

- The right alert is given immediately
- Situations of hazard do not develop into situations of accidents
- Personnel can be rescued in situations of accident
- The personnel on the facility can be quickly and efficiently evacuated at all times
- The condition can be normalised when the development of a situation of hazard and accident has been stopped

In the U.S., The U.S. Coast Guard regulates the safety of life and property on the Outer Continental Shelf (OCS) facilities and vessels engaged in OCS activities, and the safety of navigation. In addition, the USCG is responsible for promoting workplace safety and health by enforcing requirements related to personnel, workplace activities, and conditions and equipment on the OCS.

USCG regulations 33 CFR Subpart N – Outer Continental Shelf Activities are applicable and is "intended to promote safety of life and property on OCS facilities, vessels, and other units engaged in OCS activities, protect the marine environment",

Sub-parts B (Manned OCS facilities) and C (Mobile Offshore Drilling Units) in 33 CFR 146 state are relevant to drilling and well activities. Both subparts have requirements for operators to develop and submit approval Emergency Evacuation Plans (EEP) to the USCG. The EEP submissions must include, amongst other requirements:

- A description of the recognized circumstances, such as fires or blowouts, and environmental conditions, such as approaching hurricanes or ice floes, in which the facility or its personnel would be placed in jeopardy and a mass evacuation of the facility's personnel would be recommended
- For each of the circumstances and conditions described a list the pre-evacuation steps for securing operations, whether drilling or production, including the time estimates for completion and the personnel required
- For each of the circumstances and conditions described a description of the order in which personnel would be evacuated, the transportation resources to be used in the evacuation, the operational limitations for each mode of transportation specified, and the time and distance factors for initiating the evacuation
- For each of the circumstances and conditions described, identification of the means and procedures for retrieving and transferring personnel during emergency situations and the ultimate evacuation of all personnel

Furthermore, 33 CFR 146.125 outlines the requirements for emergency drills, it states:

- At least once a year, all the elements of the Emergency Evacuation Plan (EEP) relating to the evacuation of personnel from the facility must be exercised through a drill or a series of drills. The drill(s) must exercise all of the means and procedures listed in the EEP for each circumstance and condition described in the EEP.
- At least once a month, a drill must be conducted that demonstrates the ability of the facility's personnel to perform their duties and functions on the facility, as those duties and functions are described in the EEP.
- The date and time of such drills shall be reported in writing by the person in charge at the time of the drill to the owner who shall maintain this report record for a year and furnish it upon request to the U.S. Coast Guard.

3.9 APPROVALS

In summary, the Norwegian Acknowledgement of Compliance (AoC) requires analysis to be done of the applicants' facility and organizational/management systems with focus on the applicant's deviations to the regulation. In addition to the deviations they must come up with some mitigating measures to eventually comply with the regulation within a specified timeframe. In addition, to be allowed to carry out drilling operation, the operator has to apply for consent for a specific well location.

The U.S. EP/APD process seems to be a mix of the Norwegian AoC and Application for Consent, requiring the lessee or operator to detail the rig functionality, well location, and predicted well characteristics, as well as documents from USCG.

In Norway

Prior to drilling operations an Application for Consent (AfC) needs to be prepared and submitted to the authorities for approval. The AfC includes an Acknowledge of Compliance (AoC), (for more details about the AoC, see below). During the field development (after completion of the exploration drilling) a Plan for Development and Operation (PDO) shall be prepared and submitted to the authorities for approval. The PDO includes plan for drilling prior to production (for more details on PDO, see below)

Application for Consent (AfC)

According to the Information Duty Regulations Sec. 5 the operator must obtain consent prior to exploration drilling operations.

The Information Duty Regulations Sec. 6 states that the operator must submit an AfC to the PSA sufficient time in advance of planned commencement, and it provides requirements for the content of the AfC. The AfC shall, related to major accident risk, contain:

- a description of the analyses and evaluations made in relation to health, environment and safety aspects with regard to the activities and facilities comprised by the application, and the results of and the measures to be implemented in consequence of these evaluations,
- a summary of the results from the environmentally oriented risk and emergency preparedness analyses, together with a description of how the planned emergency preparedness against acute pollution has been provided for, cf. the Management Regulations Section 16 on environmentally oriented risk and emergency preparedness analyses, and the Activities Regulations Section 64 on establishing emergency preparedness,

See also the Sec. 6 for more information.

Acknowledgement of Compliance (AoC)

Petroleum Safety Authority issues acknowledgements of compliance for mobile facilities that are to conduct petroleum activities on the Norwegian part of the continental shelf. An AoC is required as a part of the Application for Consent.

An acknowledgement of compliance (AoC) is an acknowledgement from the Petroleum Safety Authority to the effect that a mobile facility's technical condition and the applicant's organisation and management system are assessed to be in conformity with relevant requirements of Norwegian rules and regulations for the petroleum activities. The owner of a mobile facility or another party who is in charge of day-to-day operation of such a facility must have obtained an AoC when such a facility participates in petroleum activities subject to Norwegian shelf jurisdiction. The AoC application may be submitted independently of a consideration of consent.

An AoC will constitute part of the documentation basis when applications are taken up for consideration by the authorities, particularly in connection with the facility-specific part of an application for consent. In itself it confers no right to initiate activities on the Norwegian shelf.

An AoC will be issued on the basis of the authorities' assessment of the condition of the facility, measured against the rules and regulations applying to the use of mobile facilities on the Norwegian continental shelf at the time of the AoC. The statement will be given based on the authority's follow-up of the applicant and the information that the applicant has provided about the facility and the organisational set-up. An AoC encompasses technical conditions, relevant parts of the applicant's management system, analyses performed, maintenance programme and upgrading plans.

Use of an AoC is conditional upon that the basis, prerequisites and other conditions given in the acknowledgement are followed up and maintained. If the prerequisites for the acknowledgement of compliance change, or the acknowledgement is based on erroneous information, the acknowledgement of compliance will no longer be valid.

When NMD requirements under the Norwegian Maritime Directorate (NMD) have been selected, these will together with the PSA requirements form the basis for Acknowledgement of Compliance (AoC) which is required by the PSA for operations of MODUs on the Norwegian Continental Shelf.

The requirement on an AoC is described in the guideline to the Framework regulations sec. 17 about General requirements to material and information, and in the AoC Handbook (OLF/NR 065 "Handbook for application for Acknowledgement of Compliance (AoC)" referred to here.

Reference is also made to OLF/NR 082 "Recommended guidelines for acceptance and operation of mobile drilling facilities holding, or in the application process for, an Acknowledgement of Compliance (AoC)".

The AoC Handbook provides information about the specific NMD requirements that can be used alternatively to technical PSA requirements.

The AoC Handbook can be found by selecting "Acknowledgement of Compliance" from the drop down menu at www.psa.no.

In the U.S., the 30 CFR 250 requires all lessees and operators to protect health, safety and the environment by:

- Controlling, removing or correcting any hazardous oil and gas accumulation or other health, safety or fire hazard.
- Using the best available and safest technology (BAST)
- Conducting all operations in a safe and workmanlike manner and
- Maintaining all equipment in good condition.

This list must be submitted to the MMS District Manager for approval.

Before any activities are performed in the GoM OCS an Exploration Plan must be submitted or if for a production well, a Development Operations Coordination Document (DOCD for the Western GoM) or Development and Production Plan (DPP for other than the Western GoM). Furthermore, an Application for Permit to Drill (APD) must be submitted. The APD relies on a Certificate of Inspection or Letter of Compliance from the USCG depending on whether U.S.or foreign flagged respectively.

Requirements for an EP are referred in 30 CFR 250.211-227. For a DPP/DOCD the requirements are recovered in 30 CFR 250.241-262. Additional information is provided in applicable NTLs.

The Coast Guard has separate ways to handle the MODU which is flagged in the U.S. and the MODU which is foreign-flagged.

The U.S. flagged vessels must meet the requirements set out in 46 CFR §107.231 to receive a Certificate of Inspection (COI). The MODU must then undergo annual inspections. In addition, the U.S. flagged MODU must be dry docked in the presence of a Coast Guard inspector at least once every 24 month period or in accordance with certain exceptions as listed in 46 CFR 107. 261 and 107.265

Most MODUs on the GoM OCS are not US-flagged, therefore the USCG provides owners of those non-US flagged MODUs with three options for compliance (33 CFR 146,205):

- Comply with the operating standards of 46 CFR part 109 or,
- The operating standards of the documenting nation if the standards provide a level of safety generally equivalent to or greater than that provided under 46 CFR part 109, or
- The operating standards for mobile offshore drilling units contained in the IMO Code for the Construction and Equipment of MODUs (IMO Assembly Resolution A. 414(XI)) which has been incorporated by reference and the requirements of 46 CFR Part 109 for matters not addressed by the Code.

Reference is also made to section 5.2.

3.10 REPORTING AND NOTIFICATIONS TO THE AUTHORITIES

In summary, no major differences has been found between the Norwegian and the U.S. with regards to reporting and notification to the authorities.

In Norway, the operator shall ensure co-coordinated and immediate telephonic alert to the Petroleum Safety Authority of situations of hazard and accident which have led to or which, under insignificantly altered circumstances, might have led to severe and acute injury, acute life-threatening illness, severe impairment or loss of safety functions or other barriers that endanger the integrity of the facility, acute pollution (IDR Sec. 11).

The operator shall ensure that the drilling and well activities program, well location and well path is submitted according to time-limits stipulated by the PSA (IDR Sec. 7) and the drilling and well activities shall be reported to on a daily basis (IDR Sec. 17).

The operator shall report damage to and incidents in connection with load bearing structures and pipeline systems to the Petroleum Safety Authority's data base Corrosion and Damage (CODAM) (IDR Sec. 18).

In the U.S., 33 CFR 146.30 requires that the owner, operator, and person in charge of an OCS facility shall ensure that the Coast Guard is notified as soon as possible after a casualty occurs, and by the most rapid means available, of each casualty involving the facility which results in: death or injury to 5 or more persons in a single incident.

Furthermore, the owner, operator, and person in charge shall ensure that the Coast Guard is notified promptly of each casualty involving the facility which results in:

- Damage affecting the usefulness of primary lifesaving or fire fighting equipment;
- Injury causing any person to be incapacitated for more than 72 hours;
- Damage to the facility exceeding $25,000 resulting from a collision by a vessel with the facility; or
- Damage to a floating OCS facility exceeding $25,000.

In addition to the notice of a casualty required, the owner, operator, or person in charge shall, within 10 days of the casualty, submit to the Officer in Charge, Marine Inspection, a written report (33 CFR 146.35).

With respect to notification of pollution incidents, the person in charge of an offshore facility that is involved in an incident, including occurrences which pose an imminent threat of oil pollution shall, as soon as possible immediately notify the incident (33 CFR 135.305).

The MMS regulation states that the operator must report the following incidents (of a certain impact as described in 30 CFR 250.188) to the District Manager immediately via oral communication, and provide a written follow-up report (hard copy or electronically transmitted) within 15 calendar days after the incident. In case of incidents of a lower level, the operator must provide a written report of the following incidents to the District Manager within 15 calendar days after the incident.

30 CFR 254.46(a) requires immediate notification to the National Response Center upon discovering and oil spill from own facility, an oil spill from another offshore facility, or an offshore spill of unknown origin.

30 CFR 254.46(b) requires notification to the MMS of spill that are one barrel or more or, if the volume is unknown, is thought to be one barrel or more. If the spill is 10 barrels or less, one must make the required notification by telefax to the appropriate MMS District office. If the spill is more than 10 barrels, one must make the required notification to the appropriate MMS office by telephone.

30 CFR 254.46(c) requires immediate notification of the appropriate MMS District office and the responsible party, if known, upon discovery of a spill resulting from operations at another offshore facility.

Drilling and well activities must be reported weekly according to 30 CFR 250.468 b.

3.11 REFERENCES

(INTERNAL NOTE: To be completed)

30 CFR Subpart

30 CFR Subpart

30 CFR 250, Subpart D—Oil and Gas Drilling Operations (400-490)

30 CFR Subpart H Oil and Gas Production Safety Systems (800-808)

Memorandum of Understanding (MOU) between Minerals Management Service, U.S. Department of the Interior and United States Coast Guard, U.S. Department of Homeland Security , signed 30 September 2004

API RP 14C Recommended Practice for Analysis, Design, Installation, and Testing of Basic Surface Safety Systems for Offshore Production Platforms,

API RP 14J, Recommended Practice for Design and Hazards Analysis for Offshore Production Facilities

33 CFR 146.30 Notice of casualties.

Minerals Management Service Notice to Lessees and Operators of Federal Oil, Gas and Sulphur Leases in the Outer Continental Shelf (NTL No. 2008-N02) Outer Continental Shelf (OCS) Inspection Program

Federal Register /Vol. 74, No. 115 /Wednesday, June 17, 2009 / Proposed Rules - Minerals Management Service 30 CFR Part 250 - Safety and Environmental Management Systems for Outer Continental Shelf Oil and Gas Operations

33 CFR 146 Operations

33 CFR 135.305 Notification procedures.

4 DRILLING AND WELL ACTIVITIES REQUIREMENTS

4.1 INTRODUCTION

This section covers the differences in regulatory requirements for specific drilling and well activities.

Drilling and well operations on the NCS must follow the PSA *"Regulations Relating To Conducting of Activities in the Petroleum Activities (The Activities Regulations)"*. The activities highlighted in this regulation range from maintenance requirements for pressure control equipment to drilling and well activities. Furthermore, NORSOK is used as an important supplement in the guidelines to the regulations defining well requirements for drilling activities, well control, well construction and barrier requirements. NORSOK D-010 *"Well integrity in drilling and well operations"* goes on to detail various specific well barrier situations throughout the lifecycle of a well and the respective recommended BOP arrangements.

The MMS requirements are structured in a different manner than the PSA requirements. In contrast to the brief performance based regulations provided by PSA, the CFRs outline task specific instructions. The instructions related to activities relevant for this report are mainly found in 30 CFR 250 subparts D, E, F which covers Drilling, Completion, and Workover Operations respectively. Furthermore, several international standards are incorporated by reference. However, it is important to mention that all pertinent standards are not referenced in the MMS requirements, e.g. API RP 53.

Also, certain NTL's (Notice to Lessees and Operators) issued by the MMS may also cover guidelines or supplemental requirements on specific issues related to Petroleum Activities.

4.2 WELL DESIGN REQUIREMENTS

In summary, Norwegian regulations leave it to the operator to show compliance to their safety philosophy and give the operator an option to use probabilistic methods. U.S. regulations give detailed requirements to the content of the Application for Permit to Drill which shall be approved by MMS.

In Norway, the PSA Activities Regulation requires having a well programme that describes the activities to be carried out and the equipment to be used, AR Sec. 72. No specific requirements are given to the well design itself. The Guidelines to Sec. 72 make reference to NORSOK D-010 (*should*, ref. Section 2.2.2 of this report) for the Well Programme and state that the Well Programme must be updated for wells that have not been completed according to plan. NORSOK D-010 requires the well to have an acceptable risk of failure (by means of risk analysis) throughout the defined life cycle of the well.

In all operations there is a fundamental principle on the NCS to have independent and tested well barriers (plural) and for each operational step the barrier elements shall be defined, AR Sec. 76. It also requires a design basis, premises, assumptions, and load case scenarios to be established for the well. Minimum design factors or other equivalent acceptance criteria shall be pre-defined for:

- *burst loads,*
- *collapse loads,*
- *axial loads,*
- *tri-axial loads.*

For probabilistic calculations of loads and ratings, the probability of failure should be less than $10^{-(3.,5)}$.

It is thus the responsibility of the operator to prove that it is in control of the operations it intends to perform. The definition of a design basis is an important starting point in this process.

The possibility of drilling relief wells from two alternative locations are required and it is required to know the well location and path at all times and they shall be chosen based on well parameters important for safe drilling.

- *In the U.S.,* the regulations 30 CFR 250 Subpart B describes the plans that must be submitted in order to commence with any activities on a specific lease.
  If a APD was not submitted with a EP or DOCD,(DPP) , submit the required number of copies of Application for Permit to Drill (APD) (Form MMS-123) and Supplemental APD Information Sheet (Form MMS– 123S). (Note see Section 3.10)

30 CFR §250.411 contain requirements for the following:

Table 4-1 Information required in addition to APD (30 CFR §250.411)

Information that you must include with an APD	Where to find a description
(a) Plat that shows locations of the proposed well.	§250.412
(b) Design criteria used for the proposed well.	§250.413
(c) Drilling prognosis	§250.414
(d) Casing and cementing programs	§250.415
(e) Diverter and BOP systems descriptions ..	§250.416
(f) Requirements for using an MODU	§250.417
(g) Additional information	§250.418

Descriptions to paragraphs in Table 4-1 are:

- The design criteria for the well,30 CFR §250.413, must address the following:
  - *Pore pressures;*
  - *Formation fracture gradients, adjusted for water depth;*
  - *Potential lost circulation zones;*
  - *Drilling fluid weights;*

- *Casing setting depths;*
- *Maximum anticipated surface pressures*

- The drilling prognosis 30 CFR §250.414 will include the procedures for drilling the well
- The casing and cementing programs, 30 CFR §250.415, must include, setting depth, casing type and grade, casing design safety factors, type and amount of cement, etc.

It is required to submit the availability of a rig to drill a relief well as well as the estimated time to do so as part of an EP, 30 CFR 250.213 (g).

In addition to the above, the MMS has issued NTLs on Standard Conditions of Approval for:

- Well Activities (NTL No. 2009-G21)
- Standard Reporting Period for the Well Activity Report (NTL No. 2009-G20),
- How to evaluate and manage wells that have a casing pressure during production (NTL No. 2009-G22).

The prescriptive nature of the U.S. regulations is shown above as it dictates what shall be part of an APD. The establishment of a specific design basis is not required, although § 250.107 provides broad requirements to protect health, safety, property, and the environment.

4.3 WELL BARRIER REQUIREMENTS

In summary, DNV did not find that 30 CFR 250 uses the terminology or concept of well barriers within this study (see Fact box 5). 30 CFR §250.420 does however give requirements to the same barrier elements (e.g. casing and cementing) described in NORSOK D-010, but it does not put elements in relation to each other in terms of barriers.

In Norway, an important principle in both the PSA Activities (AR Sec. 76) and Facilities (FaR Sec. 47) regulations is the concept of well barriers and the control of these. If a barrier fails, no other activities *shall* take place than to restore the well barrier. Activities Regulation (AR Sec. 77) states that if well control is lost it *shall* be possible to regain the well control by direct intervention or by drilling a relief well. It also requires the operator to have an action plan on how well control can be regained. The Guidelines for both sections refers to NORSOK D-010 in the area of health, working environment and safety. The standard requires the operator to define their well barriers and their acceptance criteria prior to commencement of an activity or operation. This standard also gives guidance on the acceptance criteria for a well barrier and how it can be tested and monitored, NORSOK D-010, section 15.

One of the strengths of NORSOK D-010 is the illustrative nature of describing the well barriers in form of well barrier schematics (in terms of primary and secondary) through the various phases of drilling and well design.

In the U.S., 30 CFR 250 does not use the terminology or concept of well barriers. However one paragraph ask the question; 30 CFR §250.401 *What must I do to keep wells under control?* According to the regulation, the answer is:

- *You must take necessary precautions to keep wells under control at all times. You must:*
- *Use the best available and safest drilling technology to monitor and evaluate well conditions and to minimize the potential for the well to flow or kick;*
- *Have a person onsite during drilling operations who represents your interests and can fulfill your responsibilities;*
- *Ensure that the toolpusher, operator's representative, or a member of the drilling crew maintains continuous surveillance on the rig floor from the beginning of drilling operations until the well is completed or abandoned, unless you have secured the well with blowout preventers (BOPs), bridge plugs, cement plugs, or packers;*
- *Use personnel trained according to the provisions of subpart O; and*
- *Use and maintain equipment and materials necessary to ensure the safety and protection of personnel, equipment, natural resources, and the environment.*

Further, 30 CFR §250.428 asks the question, *"What must I do in certain cementing and casing situations?"* Table 4-2 describes what is meant by "certain cementing and casing situations" as well as the actions to be taken.

Table 4-2 Actions to be taken in certain cementing and casing situations, 30 CFR §250.428

If you encounter the following situation:	Then you must . . .
(a) Have unexpected formation pressures or conditions that warrant revising your casing design.	Submit a revised casing program to the District Manager for approval.
(b) Need to increase casing setting depths more than 100 feet true vertical depth (TVD) from the approved APD due to conditions encountered during drilling operations.	Submit those changes to the District Manager for approval.
(c) Have indication of inadequate cement job (such as lost returns, cement channeling, or failure of equipment).	(1) Pressure test the casing shoe; (2) Run a temperature survey; (3) Run a cement bond log; or (4) Use a combination of these techniques.
(d) Inadequate cement job	Re-cement or take other remedial actions as approved by the District Manager.
(e) Primary cement job that did not isolate abnormal pressure intervals.	Isolate those intervals from normal pressures by squeeze cementing before you complete; suspend operations; or abandon the well, whichever occurs first.
(f) Decide to produce a well that was not originally contemplated for production.	Have at least two cemented casing strings (does not include liners) in the well. Note: All producing wells must have at least two cemented casing strings.
(g) Want to drill a well without setting conductor casing.	Submit geologic data and information to the District Manager that demonstrates the absence of shallow hydrocarbons or hazards. This information must include logging and drilling fluid-monitoring from wells previously drilled within 500 feet of the proposed well path down to the next casing point.

(h) Need to use less than required cement for the surface casing during floating drilling operations to provide protection from burst and collapse pressures.	Submit information to the District Manager that demonstrates the use of less cement is necessary.
(i) Cement across a permafrost zone	Use cement that sets before it freezes and has a low heat of hydration.
(j) Leave the annulus opposite a permafrost zone uncemented.	Fill the annulus with a liquid that has a freezing point below the minimum permafrost temperature and minimizes opposite a corrosion.

30 CFR250 (§250.420) does give requirements to the same barrier elements (e.g. casing and cementing) described in NORSOK D-010, but it does not put elements in relation to each other in terms of barriers. Typical requirements for the casing are such as to; "*properly control formation pressure and fluids"*, and *"prevent communication between separate hydrocarbon-bearing strata"*.

There are also requirements similar to the performance based requirements of the PSA, e.g: "*the casing design must include safety measures that ensure well control during drilling and safe operations during the life of the well" (§ 250.420 (b)(2)).*

Fact box 5

MMS and concept of well barriers

In the U.S. Senates Hearing 111.303 p. 52, 2009-11-19, Deputy Director Walter Cruickshank of the MMS states that "… we require redundant barriers…" under a discussion of well design. This indicates that the concept of well barriers is underlying in the requirements in 30 CFR 250.

4.4 RISER MARGIN REQUIREMENTS

In summary, NORSOK D-010 "Well integrity in drilling and well operations", has general requirement to drilling with a riser margin, but requirements to compensating risk reducing measures when not drilling with a riser margin. See also Fact box 8.

There are to DNVs knowledge no requirements to a riser margin in the U.S or similar compensating measures.

In Norway, the PSA (AR Sec. 76) refer to NORSOK D-010, for details related to riser margin. NORSOK D-010 is ambiguous when it comes to the requirement of having a riser margin. In Table 1(Fluid Column) of Section 15.1 it does state that:

"The hydrostatic pressure shall at all times be equal to the estimated or measured pore/reservoir pressure, plus a defined safety margin (e.g. riser margin, trip margin)"

Table 1 also refers to ISO 10416, which states that there should always be a safety margin which considers issues such as the riser margin. When moving into deeper waters it may not be feasible to achieve a riser margin without exceeding the formation fracture pressure, hence NORSOK section 5.4.2 (Table 4-3) opens up for alternative compensating measures to that of having a riser margin. See also Fact box 8.

Table 4-3 From NORSOK D-010 *"Well integrity in drilling and well operations"*, Sec. 5.4.2

<table>
<tr><th>No.</th><th>Element name</th><th>Additional features, requirements and guidelines</th></tr>
<tr><td>Table 1</td><td>Fluid column</td><td>
Riser margin (only applicable for vessels with a marine riser)

The fluid column is not a qualified well barrier when the marine riser has been disconnected. Planned or accidental disconnect of the marine riser, resulting in loss of the fluid well barrier shall be planned for. Procedures for planning and implementation of compensating measures shall be established.

If the uncased borehole has penetrated hydrocarbon bearing formations or abnormally pressured formations with a flow potential and the hydrostatic pressure in the well with the riser disconnected may become less than or equal to the pore/reservoir pressure of these formations, risk reducing measures shall be established with the following priority :

A. reduce the probability of having an influx during the disconnect period
B. strengthen the availability/reliability of the remaining well barrier.

The following table is listing some examples of risk reducing measures that could be applied.
<table>
<tr><th>Priority</th><th>Risk reducing measures</th><th>Comments</th></tr>
<tr><td>A</td><td>Drill with "Riser Margin"</td><td>Maintain a drilling fluid density that will provide an overbalance with the marine riser disconnected.
This alternative shall be assessed as the primary compensating measure.</td></tr>
<tr><td>A</td><td>Spot a weighted fluid</td><td>Displace the entire well or part of the well to a fluid with a density that will provide an overbalance towards zones with a flow potential with the marine riser disconnected.</td></tr>
<tr><td>B</td><td>Install a bridge plug</td><td>Install a bridge plug with storm valve below the wellhead.</td></tr>
<tr><td>B</td><td>Two shear-/seal rams</td><td>Use two shear-/seal rams in the drilling BOP as an extra seal element during hang-off / drive-off situations.</td></tr>
<tr><td></td><td></td><td></td></tr>
</table>
</td></tr>
</table>

The examples listed are however not fully equivalent to having a riser margin as a riser disconnect could occur at any instant, in which case there is insufficient time to spot a weighted fluid or to install a bridge plug. Having two shear/seal rams maybe a good idea, but it does not ensure proper sealing because of the un-shearable items discussed in 5.4.4 However, it is interpreted that in Table 4-3 it is acceptable to drill without a riser margin as long as necessary risk reducing measures have been put in place.

In the U.S., 30 CFR 250.442 states that "Before removing the marine riser, you must displace the riser with seawater. You must maintain sufficient hydrostatic pressure or take other suitable precautions to compensate for the reduction in pressure". However term Riser Margin is not used.

NTL No. 2008-G07 covers Managed Pressure Drilling (MPD) Projects with surface BOPs but not yet subsea BOPs. It does state that the NTL will be revised once the International

Association of Drilling Contractors (IADC) completes its recommended practice for MPD for both surface BOP's and subsea BOP's.

Fact box 5

What is a riser margin?

The mud column in a riser exerts greater pressure than surrounding seawater pressure since mud density is higher than the seawater density. A riser leak or disconnected riser allows mud column pressure to equalize with seawater pressure at the depth of the leak or disconnect. This difference in mud column pressure and seawater pressure is termed "riser loss". In deep water, this "riser loss" could be significant depending on water depth and mud weight. In shallow water there is typically enough hydrostatic pressure from the remaining drilling or completion fluid in the well plus the seawater to contain formation pressure in the event of a riser leak, termed "riser margin".

The riser margin is constrained by the gap or the operational window defined by the fracturing pressure at the casing shoe and hydrostatic pressure in connection with the expected pore pressure from the formation. Figure 4-1 provides an illustration of a casing program with pore pressure and fracture pressure illustrated for a deep and high pressure well.

When drilling, the most fragile formation or the lowest fracturing formation pressure is usually placed just below the last casing shoe and the highest pore pressure tends to be near to the end of that drilling phase. As the water depth becomes deeper, the gap between pore and fracturing pressures tends to be reduced substantially, and it becomes impossible to maintain a riser safety margin without exceeding the fracturing pressure. Because of this, other techniques such as underbalanced, dual gradient, and managed pressure drilling have been proposed. Although these terms may by some be considered subsets of each other, the basic idea is to get around the limitation/restriction of having a homogenous mud column open to atmospheric pressure at the surface while drilling. This may be used to better control the downhole hydrostatic pressure at the drill bit. Whereas some techniques combines a surface pressure with a lower mud weight, others use mud columns of different weights or even vary the height of the mud column within the riser. Without going into more detail on each of the variations that exist or the equipment that is necessary, some of these techniques (not all) does not ensure overbalance in the event of a riser disconnect. However because of the reasons described above, similar techniques may very well become necessary in order to drill the future deepwater wells whether the location is NCS or GoM.

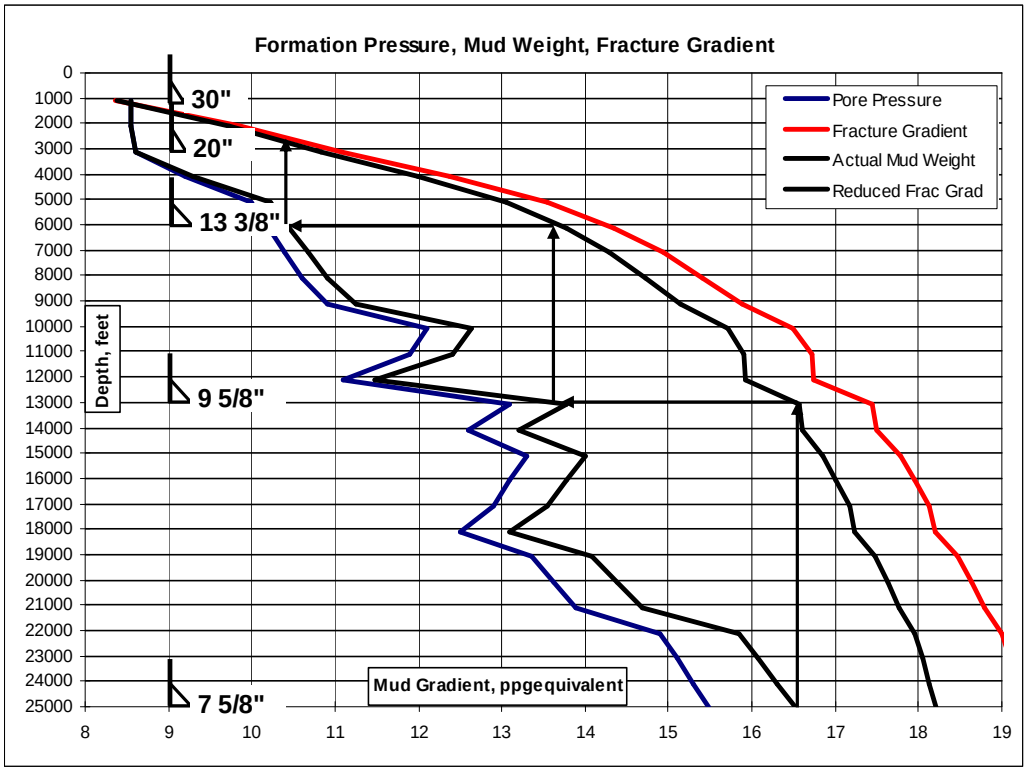

Figure 4-1 Illustration of a casing program with pore pressure

4.5 REQUIREMENTS TO CASING AND CEMENTING ACTIVITIES

In summary, Norwegian regulations gives overall requirements to cementing based on the well barrier principle while U.S. requirements are more detailed. In general the requirements are similar although presented differently. U.S. requirements require greater cement height in the casing annulus above hydrocarbon bearin zones, but requires less cement above hydrocarbon bearing zones with flow potential (500 ft vs. 200 m in NORSOK D-010).

In Norway, Neither the PSA Activities regulation nor its guideline gives any specific requirements on casing and cementing activities. There is however requirements to well barrier elements and NORSOK D-010 as discussed in 4.3.

NORSOK D-010, lists the requirements on how to design, verify and monitor casing (Table 2), casing cement (Table 22) and cement plugs (Table 24). For casing cement it is required that the casing annulus is cemented 100m above the casing shoe. Verification of this cement height is required. Testing requirements are given through formation strength testing for casing cement and maximum anticipated differential pressure for casing.

Some requirements for the cementing unit are given by FaR Sec. 51, but these are related to its design, pollution and health of the personnel operating the unit. The tendency in Norway has for a while been to get away from "black" pollutant chemicals to "green" degradable chemicals, which

also to some extent applies to the cement, for the reasons above. This may however in some instances be considered to contradict the functional purposes of using cement as a well barrier.

In the U.S., requirements to casing and cementing programs, casing and cement are given in 30 CFR §250.420. Further regulations require the casing and cementing program to include "*type and amount of cement (in cubic feet) planned for each casing string*", 30 CFR §250.415 (c). For areas with shallow water flow potentials or hazards and a water depth greater than 500ft, 30 CFR §250.415 also require a statement on how the best practices of API RP 65, "*Recommended Practice for Cementing Shallow Water Flow Zones in Deep Water Wells"* is evaluated.

Cement plugs for permanent and temporary abandonment is covered by 30 CFR 250.1715

Some additional requirements are given according to the casing type in 30 CFR §250.421, Table 4-4.

Table 4-4 Casing and cementing requirements according to casing type (30 CFR § 250.421)

Casing type	Casing requirements	Cementing requirements
(a) Drive or Structural	Set by driving, jetting, or drilling to the minimum depth as approved or prescribed by the District Manager.	If you drilled a portion of this hole, you must use enough cement to fill the annular space back to the mudline.
(b) Conductor	Design casing and select setting depths based on relevant engineering and geologic factors. These factors include the presence or absence of hydrocarbons, potential hazards, and water depths. Set casing immediately before drilling into formations known to contain oil or gas. If you encounter oil or gas or unexpected formation pressure before the planned casing point, you must set casing immediately	Use enough cement to fill the calculated annular space back to the mudline. Verify annular fill by observing cement returns. If you cannot observe cement returns, use additional cement to ensure fill-back to the mudline. For drilling on an artificial island or when using a glory hole, you must discuss the cement fill level with the District Manager.
(c) Surface	Design casing and select setting depths based on relevant engineering and geologic factors. These factors include the presence or absence of hydrocarbons, potential hazards, and water depths.	Use enough cement to fill the calculated annular space to at least 200 feet inside the conductor casing. When geologic conditions such as near-surface fractures and faulting exist, you must use enough cement to fill the calculated annular space to the mudline.
(d) Intermediate	Design casing and select setting depth based on anticipated or encountered geologic characteristics or wellbore conditions.	Use enough cement to cover and isolate all hydrocarbon-bearing zones and isolate abnormal pressure intervals from normal pressure intervals in the well. As a minimum, you must cement the annular space 500 feet above the casing shoe and 500 feet above each zone to be isolated.
(e) Production	Design casing and select setting depth based on anticipated or encountered geologic characteristics or wellbore conditions.	Use enough cement to cover or isolate all hydrocarbon-bearing zones above the shoe. As a minimum, you must cement the annular space at least 500 feet above the casing shoe and 500 feet above the uppermost hydrocarbon-bearing zone.
(f) Liners	If you use a liner as conductor or surface casing, you must set the top of the liner at least 200 feet above the previous casing/liner shoe. If you use a liner as an intermediate string below a surface string or production casing below an intermediate string, you must set the top of the liner at least 100 feet above the previous casing shoe..	Same as cementing requirements for specific casing types. For example, a liner used as intermediate casing must be cemented according to the cementing requirements for intermediate casing.

The question: "*When may I resume drilling after cementing?*" is answered in 30 CFR §250.422. This is either 8 or 12 hours depending on the type of casing (conductor, surface, intermediate, etc.). Additional requirements are given for the casing and cementing for sulphur operations in 30 CFR §250.1608.

Requirements for pressure testing of the casing are given in 30 CFR § 250.423. It is stated that:

".. if the pressure declines more than 10 percent in a 30-minute test or if there is another indication of a leak you must either re-cement, repair or run additional casing to obtain a proper seal". Minimum test pressures according to casing type are also given although the MMS District Manager may approve or require other test pressures than those listed.

Temporary cement plugs are covered in 30 CFR §250.1721.

4.6 WELL PRODUCTION TEST REQUIREMENTS

In summary, Norwegian regulation gives overall requirements to well testing based on the well barrier principle while U.S. requirements are more detailed.

In Norway, the PSA Acivity regulations (AR Sec. 78), references NORSOK D-010 Ch. 6 for well testing. This section in NORSOK details well barrier acceptance criteria, well control action plans, and gives specific well test design schematics of various scenarios. Additionally, there are further detailed design criteria in NORSOK D-SR-007 *"Well testing systems"*.

In the U.S., if well testing is to be performed, the U.S. regulations, 30 CFR §250.460, require it to be included in the APD (form MMS–123) or in an Application for Permit to Modify (APM) (form MMS–124). These plans must include the following:

- *Estimated flowing and shut-in tubing pressures;*
- *Estimated flow rates and cumulative volumes;*
- *Time duration of flow, buildup, and drawdown periods;*
- *Description and rating of surface and subsurface test equipment;*
- *Schematic drawing, showing the layout of test equipment;*
- *Description of safety equipment, including gas detectors and fire-fighting equipment;*
- *Proposed methods to handle or transport produced fluids; and*
- *Description of the test procedures.*

The MMS District Manager must be given at least 24-hours notice before starting a well test.

Fact box 6

Operating 1500m waterdepth

It is difficult to justifiably argue that there are major operational differences which impact the well safety which is *purely* related to the water depth. Equipment has been qualified to operate in larger water depths than 1,500 meters, and as such there are no technical equipment issues related to operating in these water depths.

One of the main differences related to operating in waters exceeding 1,000 meters is the ability to always operate with a riser margin which was discussed in Fact box 5. However, this is also strongly dependent on the reservoir pressure.

Other issues which could be more complicated in deeper waters are:

- Well control – The longer distance could complicate a well control operation and will have an impact on the time required to successfully conduct the well control operation.
- Gas influx – With a longer riser above the BOP the amount of gas which could migrate into the riser undetected could be significantly larger, making the circulating operation more complicated as more gas will have to be handled on the surface.

- Riser leaks – The larger number of riser joints could impact the probability of having a riser leak. On the other hand deeper waters provide a larger operating window and less exposure on the riser.

None of the points listed above can however exclusively be contributed to the water depth. In combination with other complicating factors, i.e. tight operating margins or high pressure reservoirs, water depth could however be a complicating factor.

4.7 REFERENCES

PSA Activities Regulation

PSA Facilities Regulation

NORSOK D-010, Well integrity in drilling and well operations

NORSOK D-SR-007, Well testing system

30 CFR 250, Subpart A—General (100-199)

30 CFR 250, Subpart B—Plans and Information (200-299)

30 CFR 250, Subpart D—Oil and Gas Drilling Operations (400-490)

30 CFR 250, Subpart Q—Decommissioning Activities (1700-1754)

NTL No. 2009-G21

NTL No. 2009-G20

NTL No. 2009-G22

5 FACILITY AND DRILLING SYSTEM REQUIREMENTS

5.1 INTRODUCTION

This section covers the differences in regulatory requirements for MODU and specific drilling systems.

Basic standards for drilling systems follows API standards and recommended practices which were recently has been developed into equivalent ISO standards. For facilities operating on the NCS there are additional requirements in PSA's Facilities regulation which further refers to DNV's offshore standard DNV-OS-E101 for MODUs and NORSOK D-001 *"Well integrity in drilling and well operations"*(mainly used for fixed installations).

The Department of the Interior's MMS requirements for the U.S. part of GoM are structured in a different manner than the equivalent PSA requirements. The instructions related to facilities relevant for this report are mainly found in 30 CFR 250 subparts D, E, F which covers Drilling, Completion, and Workover Operations respectively. Furthermore, several international standards are incorporated by reference.

Also, certain NTL's issued by the MMS may also cover guidelines or supplemental requirements on specific issues related to Petroleum Activities.

Maritime rig systems are in general covered by the IMO MODU code with additions in Class requirements and flag state requirements. NMD has additional requirements to rigs operating in the NCS. Rigs entering into the NCS are subject to an approval from PSA through the acknowledgement of compliance process as described in section **Error! Reference source not found.**.

5.2 RIG REQUIREMENTS

In summary, generally the US coast guard require that drilling systems shall be design according to best industry practice and are analyzed by a professional engineer at the time of new building, while the Norwegian regulations require the rig owner to assess the design and the condition of the drilling system to present valid requirements. The AoC scheme requires that the latest edition of applicable regulations and referred standards shall be used as basis for compliance irrespective of a unit's age.

In Norway, permission for operation of drilling rigs on the Norwegian Shelf is regulated through the Norwegian Petroleum Safety Authority (PSA) Acknowledgement of Compliance (AoC) scheme as described in chapter 2.2.2.

The AoC is issued as a diploma by the PSA as an acknowledgement to the effect that a mobile facility's technical condition as well as the owner/manager's organisation and management system have been assessed by PSA and found to be in conformity with relevant requirements of Norwegian rules and regulations for the petroleum activities.

In addition to having valid flag state and classification certificate the AoC scheme also requires a Mobile offshore drilling unit MODU to comply with:

- selected Norwegian Maritime Directorate (NMD) regulations
- requirements to drilling systems as stipulated in PSA Facility Regulations chapter IV "Drilling and Well Systems" which refer to DNV's offshore standard DNV-OS-E101 for MODUs or NORSOK D-001 (mainly used for fixed installations).
- requirements to the working environment stipulated in NORSOK S-002

The AoC scheme requires that the latest edition of applicable regulations and referred standards shall be used as basis for compliance irrespective of a unit's age. It is also a prerequisite for maintaining an AoC that a MODU including drilling systems are regularly evaluated according to any new editions of regulations and standards being issued.

All deviations from regulations and standards must be identified, and either be complied with or presented to the authorities as a justified deviation request. The owner is required to have a documented formal system for identification, reporting, evaluation and follow-up of deviations as part of his management system.

In the U.S., or Floating Outer Continental Shelf Facilities there are two regulatory bodies involved: MMS and USCG where each responsibility is clarified through a memorandum of understanding between the two bodies. See figure 2-1. Broadly, MMS covers structures, process safety and well control, and USCG covers machinery, lifesaving and firefighting, and stability.

Mobile Offshore Drilling Units with U.S. flag need to comply with 33CFR § 143.205, and Non US Flagged units must comply with 33CFR § 143.207. This indicates that foreign flag units need only hold a valid MODU code certificate and obtain a Letter of Compliance from USCG. In practice, USCG will inspect the foreign flag MODU for issue of a Letter of compliance, and MMS will periodically inspect the well control facilities.

As per 46CFR 58.60-11/13 the USCG indicates drilling facilities as industrial systems. Analyses, plans, diagrams, and specifications must be analyzed by a registered Professional Engineer for criteria adherence and manifest safety.

Reference is made to section 3.9.

5.2.1 MUD CONTROL SYSTEM

In summary, no major differences in the requirements are found for this system.

5.2.2 EMERGENCY SHUTDOWN SYSTEMS

In summary, no major differences in the requirements are found for this system.

5.2.3 FIRE AND GAS SYSTEMS

In summary, no major differences in the requirements are found for this system.

5.2.4 HAZARDOUS AREA CLASSIFICATION

In summary, no major differences in the requirements are found for this system.

5.2.5 DYNAMIC POSITION SYSTEM

In Summary, PSA requires that a unit performing drilling operations with a dynamic positioning system for station keeping needs to have a DP3 classification. This is the highest level of classification of station keeping systems.

No such requirements are in effect for the U.S. part of GoM at the current time.

Fact box 6

Dynamic Positioning Systems

A DP (Dynamic Positioning system) is a system which automatically holds a vessel to a wanted heading and position, or a predefined track, exclusively by means of thruster force. The term "DP system" is referring to the complete installation necessary for dynamically positioning a vessel, comprising of 1) the power system, 2) the thruster systems and 3) the DP control system.

There are three main levels to which DP systems are classed, defined by the IMO MSC/Circ. 645, "Guidelines for Vessels with Dynamic Positioning Systems". These are in referred to as IMO equipment class 1, 2 and 3. The different class societies have their own DP notations, relating to these IMO equipment class definitions, though with some individual differences based on different interpretations of the guidelines.

The main definitions for the different classes is:

- Class 1: Loss of position may occur in the event of a single failure.
- Class 2: Loss of position shall not occur in the event of a single failure of any active component or system. (Static components such as cables, piping etc is not considered).
- Class 3: As for class 2, but also including a) static components, b) loss of all components in any one watertight compartment from fire or flooding and c) loss of all components in any one fire sub division from fire or flooding

Consequently, class 2 and 3 systems require redundancy in technical design. In addition, class 3 systems require physical separation (fire insulated) between all systems and components providing the required redundancy. Also, for class 3 it is required to have a backup DP control system, in a location which is physically separated (and fire insulated) from the redundant main DP control system.

5.3 BOP

5.3.1 BOP REQUIREMENTS

In summary, Norwegian regulations require an additional super shear ram/casing shear ram to the blind shear ram, while the U.S. regulations do not.

In Norway , according to DNVs Offshore Standard DNV-OS-E101(October 2009) a DP unit is required to have two shear rams. The first is a super shear ram/casing shear ram capable of also cutting casing and drill string tool joints but without sealing capabilities . The second being a blind shear ram, with sealing capabilities, which closes in the well. Having two rams able to cut the drill string, and also one able to cut the casing, increases the rigs ability to close in and disconnect from a well in case of an emergency.

In the U.S., this is not a requirement. In fact, only one shear ram is required by §250.442(b).

It should be noted that a casing/super shear ram normally does not seal after shearing.

5.3.2 BOP CONTROL SYSTEM

In summary, Norwegian regulations require floating facilities have an alternative activation system of the BOP and a system that ensures release of the riser before a critical angle occurs. This is not a U.S. requirement. Reference is made to discussion of NTLs in section 2.2.1.

In Norway, it is a requirement that MODUs shall have an alternative activation system for activating critical functions on the BOP for use in the event of an evacuation from the rig (FaR Sec. 48). The examples that are mentioned in the guideline to FaR Sec. 48 is either a system that is acoustically operated, ROV operated or remote-controlled in some other way. This is not a direct requirement in the GoM.

There are also requirements on the NCS stating that MODUs shall be equipped with a disconnection system that secures the well and releases the riser before a critical angle occurs, (FaR Sec. 49).

The Norwegian regulation also requires three control panels with means of BOP activation, one of which shall be located in a “safe area”, FaR Sec. 48 Guidelines.

In the U.S., it seems to be indicated in MMS NTL No. 2009-G11 as guidance that BOP backup activation systems in the event that the marine riser is damaged or accidentally disconnected are also required by them, though it is not found a direct reference in the MMS regulations.

In the GoM two control panels with means of BOP activation are required, where one shall be located away from the drill floor 30 CFR §250.443.

It should also be mentioned that in the MMS Regulation 30 CFR §250.107, it is stated that“*(c) You must use the best available and safest technology (BAST) whenever practical on all exploration, development, and production operations. In general, we consider your compliance with MMS regulations to be the use of BAST”*. However, how this regulation is enforced is beyond the scope of this report.

5.3.3 CHOKE & KILL SYSTEM

In summary, no major differences in the requirements are found for this system.

5.3.4 DIVERTER SYSTEM

In summary, no major differences in the requirements are found for this system.

5.4 OVERVIEW OF BOP CONTROL SYSTEM CONCEPTS

This section is informative and has been included to give an overview of the different control systems concepts utilised on drilling rigs in both GoM and NCS.

Control systems for topside BOPs may utilize direct hydraulic power from the hydraulic power unit (HPU) for actuating function (i.e. BOP RAM). This is not feasible for subsea BOP control systems in deepwater applications as the distance from the HPU (located on the topside) to the subsea BOP, resulting in very slow response time because of the length of the control umbilical and the hydraulic volume needed to actuate a RAM.

5.4.1 DISCRETE HYDRAULIC SYSTEMS

The basic control systems used for Subsea BOPs are the *Discrete Hydraulic* systems. Here the actuating function supply and the control function are separated within the umbilical. The control function is supplied through thinner lines within the umbilical called pilot lines while the actuating supply is a thick line in the umbilical, normally supplying energy to more than one function. In addition, subsea accumulators are used to store hydraulic energy to reduce response time. Hydraulically operated directional control valves (DCVs) located within the control pod, directs hydraulic fluid to the desired ram. Each BOP function will have one pilot line operating one DCV function (within one control pod). The DCVs are actuated through the pilot lines and since the volume needed to operate the DCVs are much smaller than the BOP function itself, the response time is improved compared to the direct hydraulic systems.

5.4.2 ELECTRO-HYDRAULIC SYSTEMS

An improvement in subsea BOP control systems has been the Electro-Hydraulic system. For these systems, the pilot lines within the umbilical are replaced with electrical lines and the DCVs in the control pod are electrically actuated using solenoids. These systems can again improve the response time for the BOP control systems.

5.4.3 MULTIPLEX SYSTEMS

The latest generation of subsea BOP control systems are called *Multiplex (MUX)* control systems. Instead of having one electric line for each DCV, the communication signals for all the DCVs can be sent through the same electric cable. This requires a Subsea Electronic Module (SEM) that can read the coded signal and send electric power to the required DCV. An advantage of the MUX systems is that it eases the design of the umbilical, additional redundancy can be built into each control pod in having more than one communication line and SEMs. Further, additional diagnostics such as pressure and temperature monitoring of the well bore can be easily added.

5.4.4 API 16D, BOP CONTROL SYSTEMS

The industry standard for BOP control systems is API 16D *"Specification for Control Systems for Drilling Well Control Equipment and Control Systems for Diverter Equipment"*. For subsea BOP control systems, the standard distinguishes between Discrete Hydraulic systems and

Electro-Hydraulic/MUX systems. However for important functions such as response time, HPU pump systems, topside accumulator capacity, and shutdown panels, the requirements are the same. Therefore it is the water depth and subsequent response time of 45 seconds which will determine whether or not a Discrete Hydraulic system can be used.

Both types of systems (Discrete Hydraulic and Electro-Hydraulic/MUX systems.) require full redundancy in terms of two umbilicals with corresponding control pods. Either of the control pods can be used to actuate a ram at any given time. Actuation pressure from either of the control pods are separated by a shuttle valve that directs the fluid to the ram function. The hydraulic line from (and including) the shuttle valve to the BOP function becomes the only single point of failure for that specific BOP function.

Emergency Disconnect Sequenced Systems (EDS) to account for drive-off/drift-off situations is left optional by API 16D (according to the title of the section). It does however state that it shall be provided for deepwater applications, but it does not define what is meant by deepwater.

Backup control systems such as acoustic or ROV actuation for EDS is also left optional by the standard. In this context it is important to understand that a Subsea BOP control system is designed as fail- as-is (FAI) and must be actuated by hydraulic power through the control umbilical. The subsea accumulators located on the Subsea BOP are not required by API 16D to store additional hydraulic energy that can be utilized for EDS if hydraulic supply from the rig is lost. The subsea accumulators are sized to reduce the response time of the BOP (ref. API 16D sec. 5.2.3.1). The amount of subsea accumulation may however be accounted for in the overall volumetric capacity requirement (topside and subsea) for the BOP control system. For ROV actuation, the ROV will therefore have to supply the energy needed to operate the BOP functions if the umbilicals have been disconnected. However, if an acoustic package is included, this will have a dedicated accumulator that can be used if hydraulic supply is lost.

Functions like *Autoshear* in the event of a LMRP disconnect or *Deadman Systems* in the event that all communication with the rig is lost is also left optional by API 16D. The standard does however mention these systems in the context of deepwater/harsh environment operations. If these systems are incorporated, the BOP control system will in principle change from FAI to Fail-Safe-Close (FSC), but it does not mean that the complete function of shearing and sealing is ensured due to unshearable items (bottom hole assemblies/drill bits, centralizers, casing and liner collars, drill pipe tool joints). So even though OLF Guideline 070 *"Application of IEC 61508 and IEC 61511 in the Norwegian petroleum industry"* requires the blind shear ram function to have a SIL 2 for prevention of a blowout, the actual probability of failure on demand is much higher than 10^{-2} . The reason for this is that the probability of hitting unshearable items is not taken into consideration in the SIL calculations.

Modern BOP control systems do have Integrated Software Dependent Systems and this section has been included to give an overview on the regulatory status for systems that depend on embedded software to function, i.e. Integrated Software Dependent Systems (ISDS). Both US and Norwegian rules are similar in that they do not explicitly address software quality and reliability. Software is an increasingly important component of control and instrumentation systems. Currently, surveyors' only contact with software is indirect - through testing the hardware it drives. For example, while hardware designs are verified prior to construction, software designs are not.

Unlike hardware, software does not wear out. All the defects to be found in software were delivered with it, except for those inserted as a result of subsequent modification. This means that any additional safety barriers for software (beyond the hardware safety barriers) must be inserted in the software development process. The most widely applied standard for ISDS, IEC 61508, says very little about the software development process. IEC 61508 is also ambiguous about the role of independent verification, "the supplier may be responsible for conformance". Section 7.4.4.5 says the coding standards must be approved by the "assessor", but the nature of the assessor is not explained. Section 7.4.6.2 says that each module of code should be "reviewed", but does not provide any guidance on the nature of the review ("peer review" for example). Section 6.4 says verification is required at the end of design, but it is unclear to which software design activity this applies. Annex A contains a list of recommended engineering techniques. However, the Annex says little about verification activities. Peer reviews and automated code analysis are, for example, not mentioned.

5.4.5 WORKOVER SYSTEMS

The design of the workover control systems (WOCS) used to refer to API 16D for, before the release of ISO 13628-7 *"Completion/workover riser systems"* in 2005. However ISO 13628-7 has taken a different approach than API 16D with respect to the design of the control system. Instead of FAI, these systems are FSC. This means that they do have sufficient hydraulic power to run the BOP functions if the umbilical is disconnected. And in fact, because of this, these systems are run with only one umbilical instead of two. There are however a couple of significant differences between a workover BOP (typically referred to as Lower Workover Riser Package (LWRP)) and a drilling BOP; the main one being the size of the bore. While drilling BOPs are sized for the wellhead (typically 21" diameter), LWRPs are sized for the production tubing (typically 7"). This makes a substantial difference with respect to the amount of fluid needed to operate the rams and consequently the sizing of the accumulators. The amount of accumulators needed for the current drilling BOPs already has big influence of the size and weight of the drilling BOP, so to add more accumulators to make it fully FSC may not be feasible.

The second difference is the lack of tool joints when running coiled tubing and wireline. Therefore automatic shear/seal functions initiated by pushing a button on the emergency shutdown panel (i.e. ESD, EQD) are more likely to succeed in theory for workover systems.

The third difference is that workover operations are often performed in underbalance therefore it is imperative that the well can be shut off in the event of an emergency such as a riser disconnect.

5.5 PRESSURE CONTROL EQUIPMENT INSPECTION AND TEST REQUIREMENTS

In summary, Norwegian regulations require a risk-based maintenance program and recertification of BOPs every fifth year but similar requirements have not been found in the U.S. regulations. which is not matched by the U.S. regulations. However, the U.S. regulations require a visual inspection of marine riser and BOP every third day, which differs from the Norwegian regulations. Requirements to record keeping of periodic BOP testing are similar for both regulations (14 day interval for BOP pressure testing, 7 day interval for function testing).

Otherwise both the PSA Activities Regulations (Section 42) and 30 CFR §250.107 have approximately the same overall requirements for general maintenance of facility and equipment.

In Norway, the regulations require the maintenance program to be risk-based (AR Sec. 44) according to the criticality of the equipment and/or function. Further the Norwegian regulations state that well control equipment shall be recertified every 5 years (AR Sec. 48).

Periodic pressure testing of the BOP shall be carried out every 14 days during operation as well as function testing every 7 days, AR Sec. 48 Guideline reference to NORSOK D-010 “Well integrity in drilling and well operations".

The Norwegian regulations refer to NORSOK D-010, ISO 10417 “Petroleum and natural gas industries -- Subsurface safety valve systems -- Design, installation, operation and repair”, and ISO 10423 “Petroleum and natural gas industries -- Drilling and production equipment -- Wellhead and christmas tree equipment” for maintenance of well control systems, AR Sec. 44 Guidelines.

In the U.S., the regulations refer to API RP 53 ” Recommended Practices for Blowout Prevention Equipment Systems for Drilling Wells” for maintenance requirements. This reference states that well control equipment should be disassembled every 3-5 years. There are no specific requirements to recertification other than this. However, implementation of these requirements by the MMS is outside the scope of this report.

It is required to do periodic pressure testing of the BOP every 14 days during operation as well as function testing every 7 days, 30 CFR §250.447, §250.449.

The U.S. regulations also require visual inspection (by cameras or ROV) of the BOP and marine riser every 3 days in operation if weather and sea conditions permit, 30 CFR § 250.446. For maintenance of well control equipment API 53 is referred to, 30 CFR §250.446

5.6 REFERENCES

PSA Facilities Regulations

30 CFR 250, Subpart D—Oil and Gas Drilling Operations (400-490)

OLF Guideline 070 “APPLICATION OF IEC 61508 AND IEC 61511 IN THE NORWEGIAN PETROLEUM INDUSTRY”

API 16D ,”Specification for Control Systems for Drilling Well Control Equipment and Control Systems for Diverter Equipment.”

DNV-OS-E101, “Drilling Plant”, October 2009

ISO 13628-7, “Completion/workover riser systems”, 2005

MMS NTL No. 2009-G11

6 OIL SPILL PREPAREDNESS REQUIREMENTS

6.1 INTRODUCTION

Strong regulations for management systems, drilling activities, and facilities are not sufficient, in and of themselves, to completely eliminate the chance of an oil spill. Therefore, regulatory authorities should have a strategy for handling oil spills. These plans should have a focus on rapid response in the critical early stages and highlight the importance of having a skilled management organization equipped for a long-term oil spill action. This chapter looks into how the oil spill preparedness is planned, organized and managed in Norway and in the U. S.

6.2 OIL SPILL RESPONSE FRAMEWORKS OVERVIEW

In summary, the Norwegian emergency preparedness against pollution is risk-based. The design of pollution prevention and its link to emergency preparedness plans is based on environmental risk analyses for acute pollution. The risk of oil spill to the environmental is dependent on the activity of the individual installations and on the sensitivity of the surrounding environment. The capacity need of the oil spill prevention is based on a weighted blowout rate and duration (for exploration drilling) or on a 90 percentile of possible blowout rates (from producing offshore installation and field developments). For each oil field and exploration drilling location the effectiveness of oil recovery systems are calculated dependent of the area specific weather, operational light conditions and oil weathering data. In contrast, the U. S. bases emergency preparedness on a “worst case” spill scenarios basis. The design is not specific in regard to the weather conditions, operative combating efficiency, and its effectiveness in reducing environmental impact.

In Norway, the Norwegian Costal Administration Department of Emergency Response has the overall responsibility for coordinating, organising and managing the state pollution contingency within Norway and the Norwegian economic zone. (Pollution Control Act sec. 43). The NCA also has the authority to coordinate all contingency organizations into one national emergency response system.

All oil companies operating on the Norwegian Continental Shelf (NCS) are required by governmental regulation (Pollution Control Act. Sec 40) to organise sufficient oil spill preparedness related to environmental- and economic risk and consequences of their activity. The following regulations legislated by the PSA to ensure sufficient oil spill preparedness:

- The Framework Regulations
- The Management Regulations
- The Information’s Duty Regulations
- The Activities Regulations
- The Facilities Regulations

In short, the Norwegian regulations require the following measures: The party responsible for the operation of a facility shall prepare an emergency preparedness strategy against acute pollution.

A quantitative environmentally risk analysis shall form the basis for any emergency plans. The emergency preparedness strategy shall provide for protection of ocean, coastal areas and shoreline (AR Sec. 64). Prior to carrying out the emergency preparedness analyses, the operator shall set objectives for protection of prioritised vulnerable resources (MR Sec. 16). Emergency preparedness analysis shall be carried out in respect of the facility including results from characterisation of oil, chemicals and the actual efficiency figures for emergency preparedness equipment. The results from the environmental risk analysis and the oil spill emergency preparedness analysis shall be assessed according to established acceptance criteria for environmental risk and uptake capacity and mobilization time criteria (MR Sec. 6).

Sufficient time in advance of a planned start-up of an activity that may entail pollution or danger of pollution, the operator (or risk owner) shall submit to government a summary of the results from the environmental risk- and oil spill contingency analyses, together with an emergency preparedness plan. The preparedness plan shall document that the emergency preparedness organization have the necessary functions to be capable of implementing actions against acute pollution effectively. The Climate and Pollution Agency (Klif) may in particular cases stipulate further requirements with regard to the establishment of this emergency preparedness (AR Sec. 64, 66 and 67).). This has been performed for drillings in coastal and sensitive environments (ex. Barents Sea).

The oil spill combating equipment that is included in the emergency preparedness analysis and plan shall have been tested under realistic conditions with regard to functional and operative qualities and collection efficiency. The equipment shall be adapted to the physical and chemical properties of the pollution and to operative conditions at sea, along the coast and shoreline. Weather, wind and current related efficiency figures shall be determined in respect of different types of material based on documented and relevant capacity figures (FR Sec. 41).

The emergency preparedness measures of the operator shall be suitable for coordination with public emergency preparedness resources. The operator is responsible for managing and coordinating the operations of the emergency preparedness resources in the event of accidents and hazardous situations (FA Sec. 29). The operators shall also cooperate with operators of other production licences on the emergency preparedness against acute pollution. There shall be established regions with common emergency preparedness plans and common emergency preparedness resources. The Klif agency may, by individual decisions, stipulate more detailed requirements with regard to regions (FA Sec. 30).

The regional emergency preparedness against acute pollution is regulated in agreement with the risk owners and shall at all times provide for and be updated in relation to the environmental risk represented by the facilities in the region. Regional plans for remote measurement of acute pollution on the open sea, in coastal areas and in the shoreline shall be established (AR Sec. 69).

In the case of acute pollution there shall, as soon as possible, be produced an action plan for implementation of action. The first version of the plan shall be ready at the latest one hour after the executive emergency response management group for the operation has been established. The plan shall be sent to the Norwegian Coastal Administration and updated regularly through all the phases of the operation. The operation shall not be concluded until the objectives in the activity plan have been achieved, and until the achievements has been documented (AR Sec 70). NCA will monitor / supervise the operator's handling of the incident. NCA will also cooperate closely with regard to PSA. Including knowledge of the emission source (well, leak, etc.).

In the U. S., MMS main regulation governing oil spill response plans is 30CFR 254 which requires the submission of an oil spill response plan and details the specific requirements that must be provided. MMS also provides additional guidance in NTL2006 –G21for the preparation of Regional and Subregional Oil Spill Response Plans. All plans must be consistent with the National Oil and Hazardous Substances Pollution Contingency Plan (NCP)**.**

The purpose of the NCP is to ensure efficient, coordinated, and effective response to discharges of oil and other hazardous substances. The NCP contains the following:

- The national response organization that may be activated in response actions.
- Coordinate responsibilities among the federal, state, and local governments
- Describes resources that are available for response.
- Establishes requirements for federal, regional, and area contingency plans.
- Provide procedures for undertaking oil and hazardous substances removal actions.
- Provide procedures for involving state governments in the initiation, development, selection, and implementation of response actions.
- Identifies federal trustees for natural resources for purposes of CERCLA[1] and the CWA[2]
- Provides procedures for the participation of other persons in response actions.
- Provides national procedures for the use of dispersants and other chemicals in response operations.

30 CFR 254.46 (a, b and c), defines the requirements of oil spill notification to the MMS

6.3 OIL SPILL RESPONSE ORGANIZATION

In Summary, The Norwegian oil spill preparedness is organized in a three pillars of oil spill response based on the national, municipal and private industry preparedness. The U.S. oil spill response organization is based on a layered approach, with a National Level National Response Team, Regional Response Teams and Area Committees. Federal, state, local government, port authorities NGOs and private sector are also integrated into the layers.

6.3.1 THE NORWEGIAN OIL SPILL RESPONSE ORGANISATION

In Norway, the oil spill preparedness is organised into three pillars of spill response

- National

[1] The Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) , as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA). CERCLA provides the federal response authority to address the problem of uncontrolled hazardous waste sites.

[2] The Clean Water Act, or the Federal Water Pollution Control Act, as it is more properly known, was passed in 1972 . its purpose is to stop pollutants from being discharged into the waterways of the United States

- Municipal
- Private industry – offshore oil industry (NOFO)

National oil spill response

The NCA manages, among other responsibilities; the Norwegian governmental's response to oil spills and other hazardous materials. The NCA is the regulatory authority for municipal and industry/private oil spill response operations.

The government provides a contingency plan for major incidents involving pollution which is not covered by municipal or private contingency preparedness. The NCA is responsible for making sure that a sufficient response to an incident is taken. If the NCA consider the municipal or industry response insufficient, then it has the option to respond itself.

Municipal oil spill preparedness

Municipalities shall provide the necessary contingency equipment/resources to combat minor oil spills within the municipality itself, and not covered by the contingency equipment/resources available to the polluter.

The municipal spill preparedness units are organised into thirty-four larger units called inter municipal preparedness regions (IUA). IUAs are organized to handle spills that are too large for one municipal to handle alone. The IUAs are shown on the map in Figure 6-1. The municipal contingency is regulated by The Pollution Control Act of 1981.

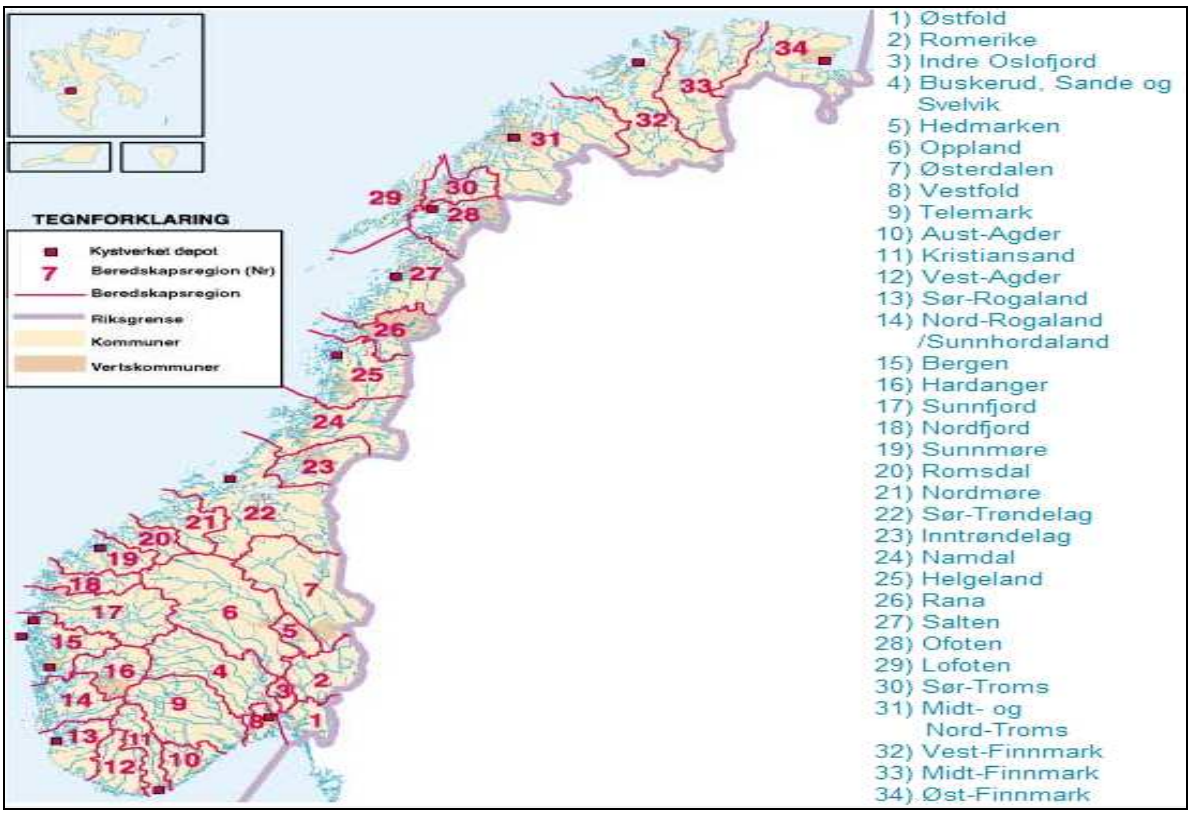

Figure 6-1 Municipals organised in 34 IUA units.

Private industry oil spill preparedness

The Climate and Pollution Agency (Klif) is under the Ministry of the Environment and regulates the private industry's preparedness. The general principle in the Pollution Control Act is that each operating company is responsible for safe operations and to establish oil spill response based on its own activities. In the event of a major oil spill, the responsible operating company is in charge of all actions needed to be taken to regain control and to return the environment to its original state before the accident. To fulfil all requirements of emergency response, the operating companies on the Norwegian continental shelf have organised a body called "the Norwegian Clean Seas Association For Operating Companies" (NOFO) that provides a national oil spill response competence, operating staff and spill response equipment/resources.

The Response Organizations

In case of an oil spill situation (e,g,, ship accident), the NCA forms an operational staff in the main office of the Department of the Emergency Responce in Horten. From this location, NCA manages any governmental managed oil spill operation for at least the first 24 hours. Then the operational staff will relocate as close to the spill site as practical.. The Coast Guard vessels will on the behalf of the NCA be engaged in the oil recovery operations and manage all sea-going oil recovery resources. Near shore and onshore operations are managed on the behalf of the NCA by the local IUA. Dependent on the spill situation the NCA will notify NOFO to respond. The Maritime directorate will assist in connection with ship owners to how identify the best way of salvaging or handling the shipwreck. The ship-owner that, by the Pollution Control Act is the polluter, will be the responsible party.

Figure 6-2 gives a picture of how the national contingency is organised when operated by the government. The NCA organisation coordinates the spill response and resources on behalf of the government and the Ministry of Fisheries and Costal Affairs. As shown, the national, municipal and private (NOFO) resources are organised as one operational national oil spill recovery organisation. The costs/expenses of the operations will be sent to the responsible polluter.

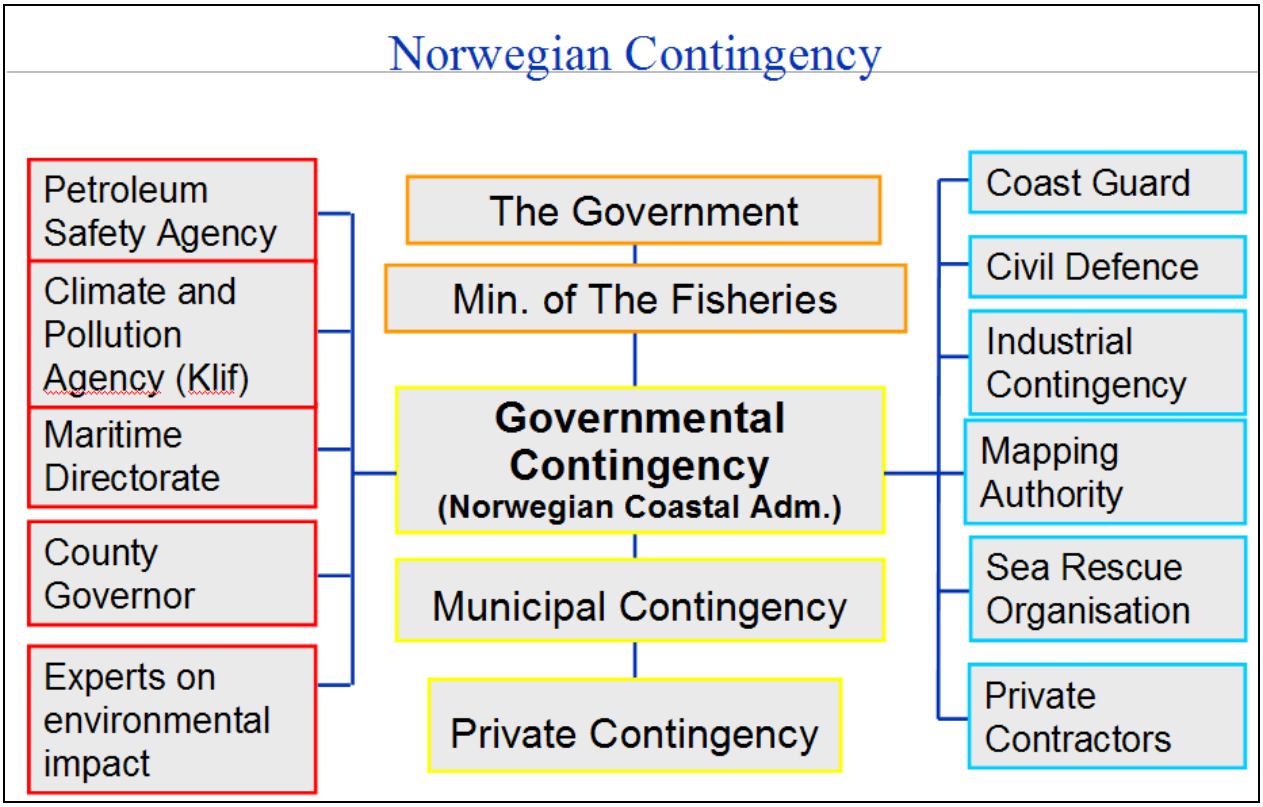

Figure 6-2 Norwegian national oil spill organisation

Compared to a shipping accident, oil spill from an offshore installation will be organised differently. As shown in Figure 6-3, the same response resources are involved, but the company responsible for the spill will notify the PSA and the NOFO. NOFO will then organize an operational staff and the required oil spill recovery resources. On behalf of the oil company, NOFO will also notify municipal contingency and other needed recourses to combat the oil spill. NCA in cooperation with the PSA will supervise how the responsible party takes action and handles the oil spill situation.

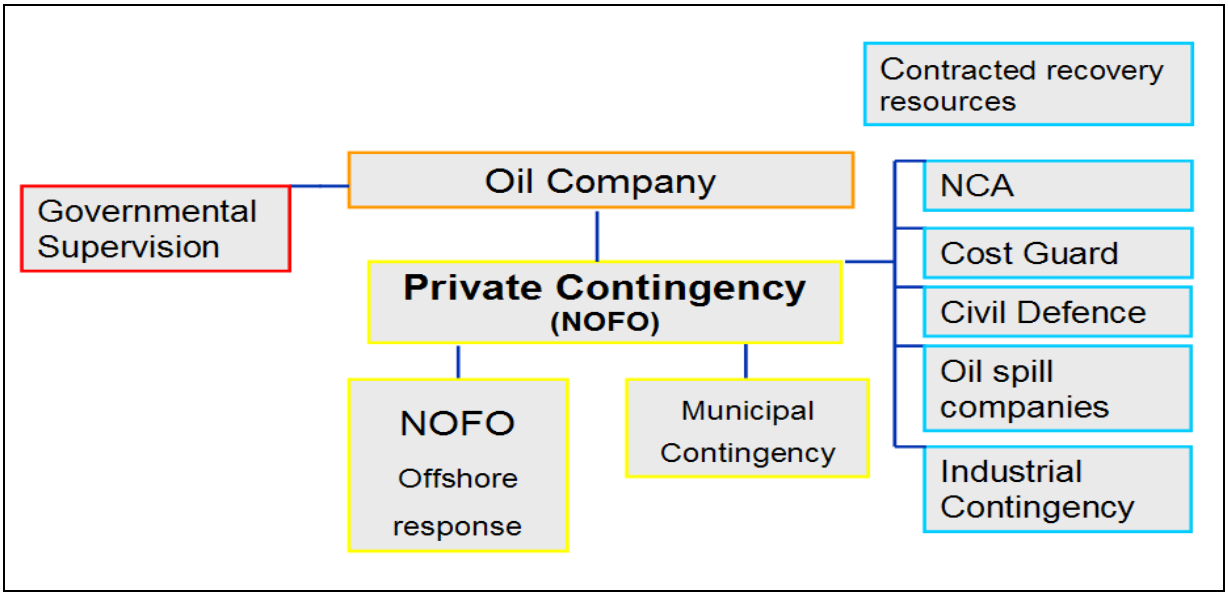

Figure 6-3 Gives an organization chart in the event of an offshore oil spill. Gsupervision is provided by the NCA/PSA.

6.3.2 THE U. S. OIL SPILL RESPNOSE ORGANISATION

In U. S., the EPA[3] and USCG[4] are the primary agencies that coordinate the NCP preparedness and response activities and assign Federal On-Scene Coordinators (FOSCs). EPA is the lead agency for assigning FOSCs for inland areas, and USCG is responsible for assigning FOSCs in the coastal areas. Thus, the USCG has ultimate responsibility for oil spill response efforts in areas such as the Gulf of Mexico.

As a part of 40 CFR 300 MMS administers the oil spill response technology research and helps establish oil discharge contingency planning requirements for offshore facilities.

The NCP outlines the organizational requirements for National Response System, which include:

- National Response Team (NRT)
- National Response Center (NRC)
- Regional Response Teams (RRTs)
- Federal On-Scene Coordinators (FOSCs)
- Area Committees
- State/Local Governments
- Special Teams

[3] Environmental Protection Agency, an independent agency reporting directly to the President and the primary agency responsible for regulating environmental policy.
[4] The United States Coast Guard, and agency within the Department of Homeland Security (DHS), the primary agency to enforce maritime legislation.

- Joint Response Teams with neighbouring countries
- Regulated Industry

Figure 6-4 gives an overview of the preparedness framework integration.

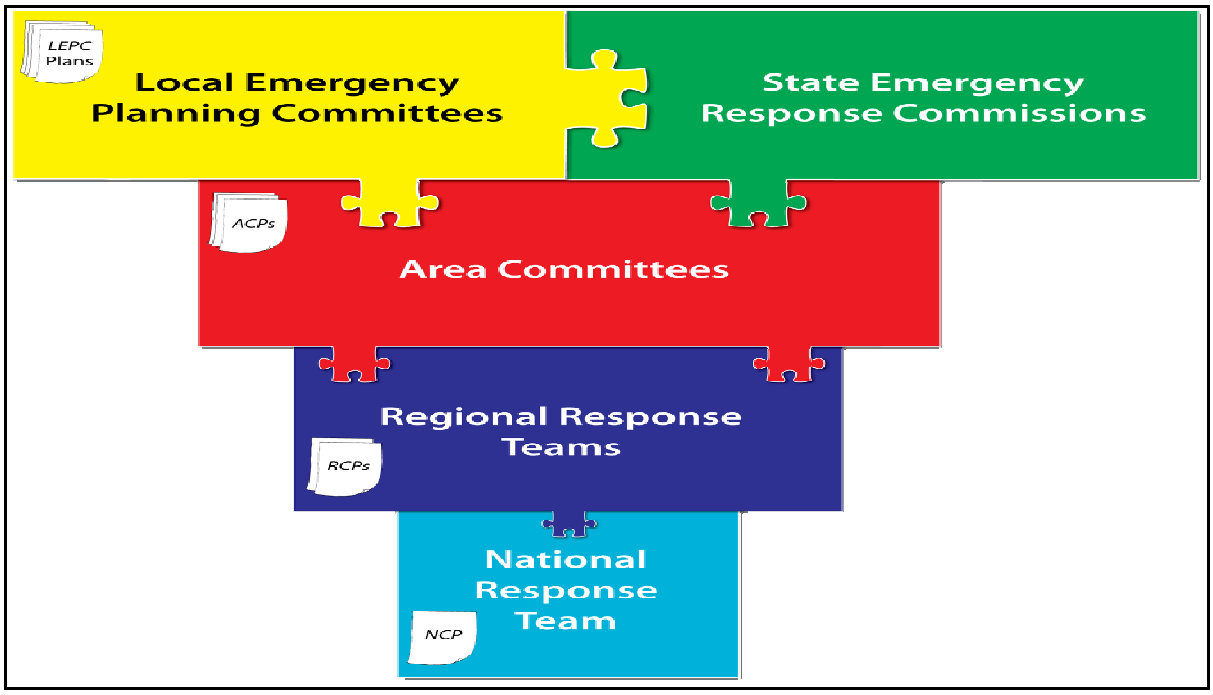

Figure 6-4 Preparedness framework Integration

Following is a brief description of the principal elements of the National Response System:

The National Response Team (NRT)

The NRT consists of 15 Federal departments and agencies and is responsible for national response and preparedness planning, coordinating regional planning, and providing policy guidance and support to the Regional Response Teams (RRTs). The EPA and USCG serve as Chair and Vice Chair, respectively. NRT members are:

- The Environmental Protection Agency
- U.S. Coast Guard
- U.S. Department of Agriculture
- U.S. Department of Commerce/National Oceanographic and Atmospheric Administration
    - National Oceanographic and Atmospheric Administration
    - Office of Response and Restoration
    - NOAA's National Ocean Service
- U.S. Department of Defence

- U.S. Department of Energy
    - Office of Environmental Health and Safety
    - National Nuclear Security Administration
- U.S. Department of Health and Human Services
    - Centre for Disease Control and Prevention (CDC)
    - National Institute for Occupational Safety and Health at the CDC
- U.S. Department of the Interior
    - Office of Environmental Policy and Compliance: Training Module
    - Minerals Management Service
- U.S. Department of Justice
- U.S. Department of Labour
    - Occupational Safety and Health Administration
- U.S. Department of Transportation
    - The Pipeline and Hazardous Materials Safety Administration
- Federal Emergency Management Agency
    - FEMA: Global Emergency Management System
- U.S. General Services Administration
- U.S. Nuclear Regulatory Commission
- U.S. Department of State

Regional Response Teams (RRT):

The RRTs are responsible for planning and coordinating regional preparedness, as well as planning and coordinating response actions in support of the Federal On-Scene Coordinator (FOSC). The U.S. has 13 RRTs, one for each established federal region, plus Alaska, Oceania, and the Caribbean. The RRTs' members include the representatives of 15 NRT member agencies, plus corresponding state representatives. RRT 6 and RRT 4 cover the Gulf of Mexico. Figure 6-5 show the jurisdiction of the RRTs.

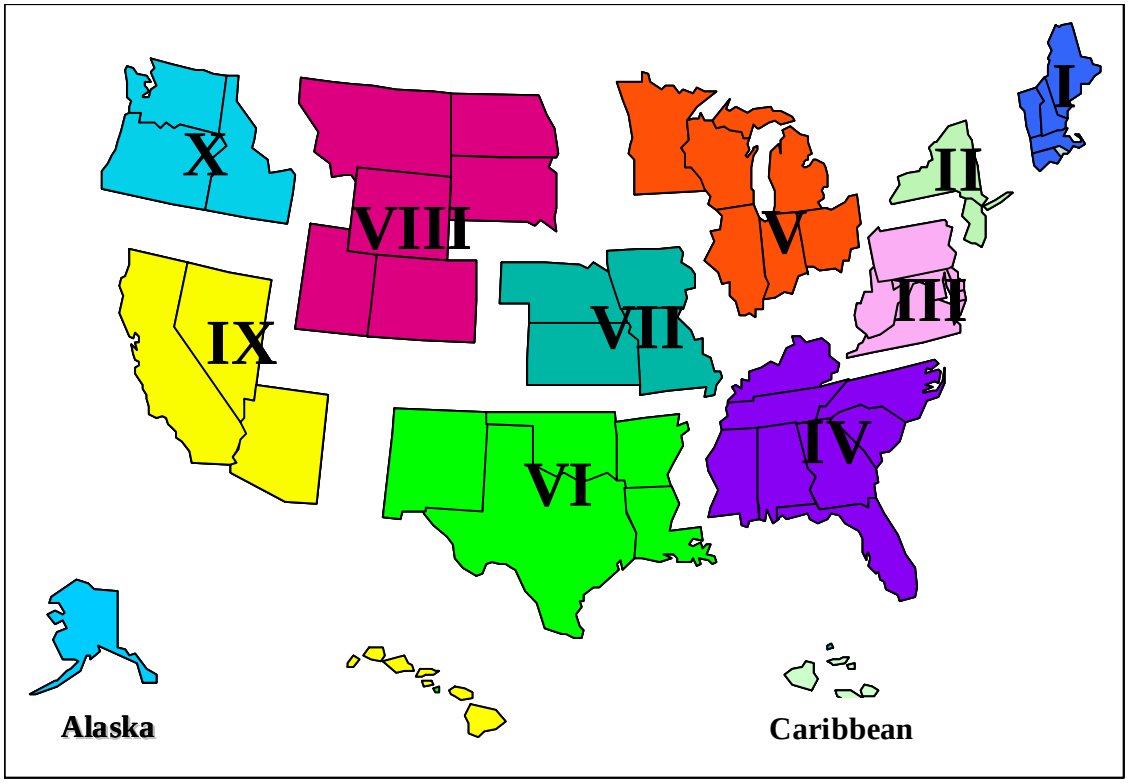

Figure 6-5 Regional Response Teams

Area Committees:

Area Committees are comprised of qualified personnel from federal, state, and local agencies in addition to the industry regulators. Under the direction of corresponding Federal On-Scene Coordinator, the Area Committees are responsible for developing an Area Committee Plan (ACP) for responding to spills inside its jurisdiction. In addition, Area Committees enhance the contingency plan through pre-planning of joint response efforts and developing appropriate procedures for mechanical recovery, dispersal, shoreline cleanup, protection of sensitive environmental areas, and safeguarding the fisheries and wildlife. Figure 6-6 depict the areas of responsibilities for the coastal COTP/FOSC.

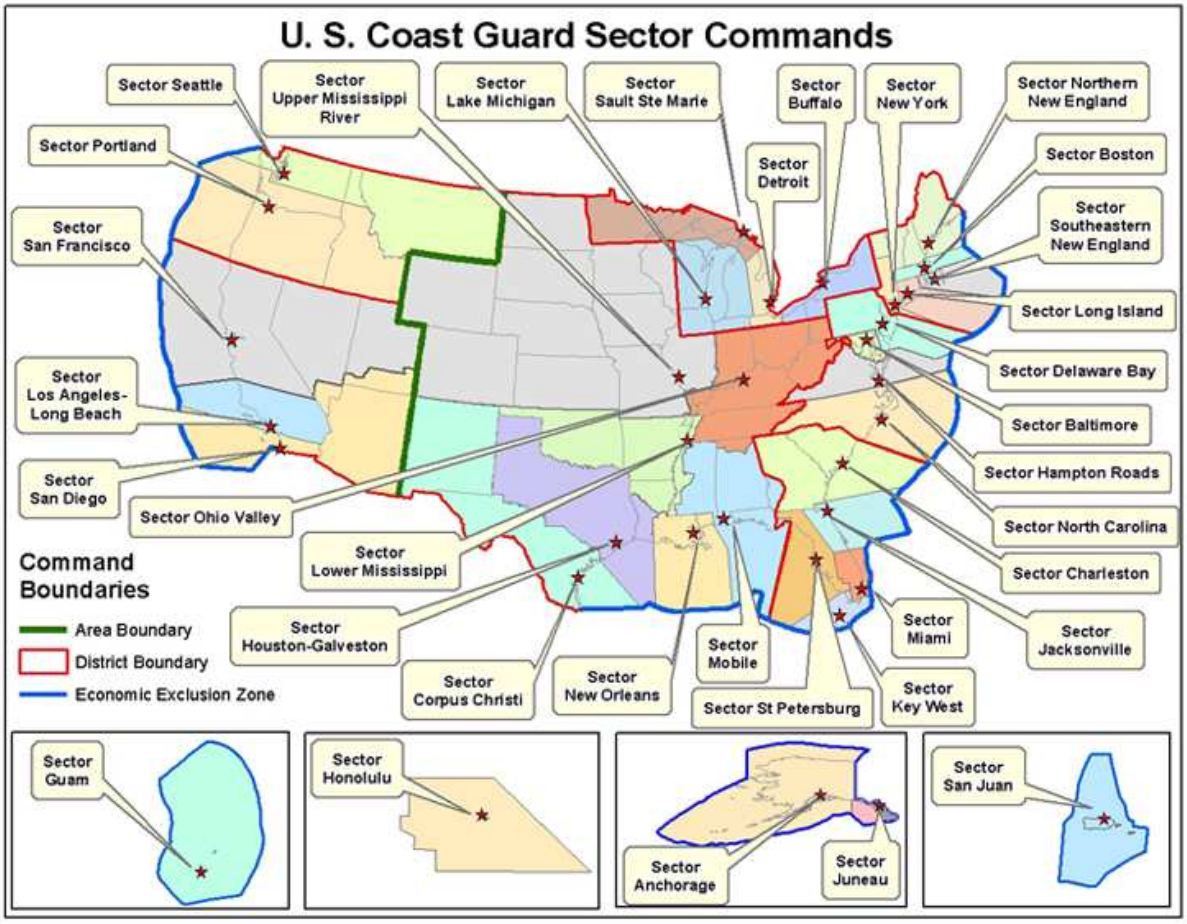

Figure 6-6 Areas of responsibilities for the coastal COTP/FOSC

The National Response Centre (NRC):

The NCP requires that the Federal Government be notified of oil and hazardous substances releases. For oil, a spill of oil that causes a sheen or emulsion in the water must be reported to the NRC. The NRC is staffed 24 hours by the USCG. Upon notification of a spill, the NRC then notifies the pre-designated On-Scene Coordinator to organize the response effort as needed. If the spill is related to petroleum activities in the GoM, then MMS will also be notified.

The Federal On-Scene Coordinators (FOSCs):

The NCP requires the responsible Federal agencies (EPA or USCG) to pre-designate FOSCs. The USCG Captains of the Port (COTP) are the pre-designated FOSCs for the coastal zone. The FOSC conduct, direct, and coordinate emergency response actions as needed. There are approximately 250 pre-designated EPA OSCs and 35 pre-designated USCG OSCs

The Response Organisation

The Incident Command System (ICS):

The National Incident Management System (NIMS) requires the use of an ICS, and the NCP states the ICS shall be under the direction of the FOSC. . The Incident Command System (ICS) acts as a unified command center and provides a common response organization during the response effort. The basic framework brings together agencies from the federal and state governments, in addition to the responsible party to achieve an effective and efficient response, It is important to note that the FOSC has the primary authority. The ICS is commonly used and endorsed system by the USCG, EPA and MMS and other U.S. federal and state agencies as the response management system for oil spills in the coastal zone.

The organization of the ICS is built around five major management activities, which are as follows:

- Command: Sets objectives and priorities and has overall responsibility at the incident or event.
- Operations: Conducts tactical operations to carry out the plan and develops the tactical objectives, sets organization, and directs all resources.
- Planning: Develops the action plan according to the objectives, processes information, and maintains resource status.
- Logistics: Provides resources and all other services needed to support the response.
- Finance/Administration: Monitors costs related to the response and provides accounting, procurement, time recording, and cost analysis.

These five management activities are the basic foundation for building the ICS organizational structure. Figure 6-7 shows a typical ICS structure.

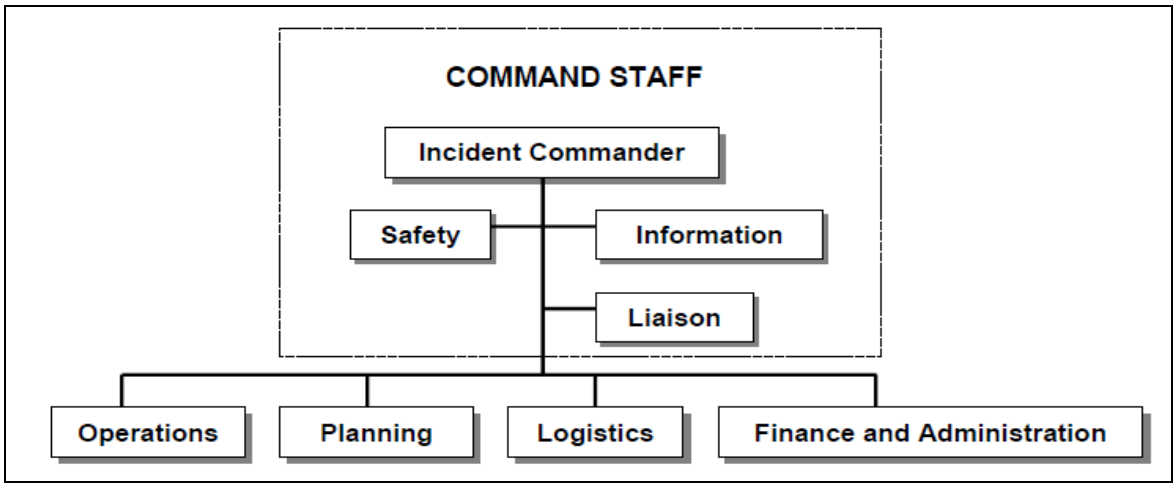

Figure 6-7 Typical ICS structure

Spills of National Significance (SONS): A SONS is a rare, catastrophic spill which greatly exceeds the response capabilities at the local and regional levels. When responding to an incident of this magnitude, the USCG uses the ICS as its response management structure with the addition of a strategic management and support functions from the ICS Area Command. The NCP in 40 CFR 300.323 states that for a SONS in the coastal zone, the USCG Commandant may name a National Incident Commander (NIC) who will assume the role of the On Scene Coordinator communicating with affected parties and the public, and coordinating federal, state, local, and international resources at the national level. This strategic coordination will involve, as appropriate, the National Response Team, Regional Response Team(s), the Governor(s) of affected state(s), and the mayor(s) or other chief executive(s) of local government(s).

The 2010 Gulf of Mexico spill is the first event that has been declared a SONS since the inception of the concept.

6.4 PREPAREDNESS PLANNING AND RESPONSE

In Summary, the Norwegian government and offshore industry response plans are risk-based, rather than "worst case" like the U.S..

Education, training, and exercise activities within the Norwegian governmental and private oil spill preparedness are regulated by the functional based principles in the "Pollution Control Act" (1981).

In the U.S., the MMS sets the requirements and approves individual OCS facilities oil spill contingency plans. Even though the USCG coordinates the oil spill response, the agency does not require an internal review of the plans. The PREP is a unified federal effort and satisfies the exercise requirements.

In Norway, the government's emergency response planning is risk-based. The planning focuses mainly on ship traffic and responding to possible accidents along the coast. The NCA managed and maintained the government's contingency plans .

The government's preparedness plan incorporates both national, international, and private agreements. The purpose of including these agreements into the contingency plans is to ensure a quick and efficient response. Some associated partners are shown in Figure 6-2.

NCA has the option in large oil spills to mobilise and coordinate all national resources into one national oil spill organisation. This also includes spills from the offshore industry.

To further ensure efficient and fast response, NOFO has an agreement that gives the oil industry access to governmental and municipal spill response resources in addition to private company's oil spill recovery resources.

International agreements

To ensure assistance in case of a large oil spill in Norwegian waters, Norway is part in the following international agreements:

- Norway have ratified the OPRC Convention
- The Bonn Agreement (covering the North Sea area)
- The Copenhagen Agreement between the Nordic countries
- The NorBrit Agreement (an agreement between Norway and U.K.)
- The Barents Sea Agreement (covering Russian and Norwegian waters in the Barents Sea region)
- European Union - EMSA – Assistance and support through MIC
- European Union (MEPC) – Assistance and support through MIC

The Norwegian government oil spill planning organisation has been based on an environmental risk assessment (SFT 2001). As a result of the assessment, depots with oil spill recovery equipment are placed along the coast, see Figure 6-8. Every depot has trained staff that, when needed, can participate in an oil spill response as experts. Oil spill equipment owned bt NCA is installed on several Coast Guard vessels. The environmental risk assessment is regularly revised and updated due to changes in ship traffic. A new revision of the environmental risk assessment will be finalized in 2010 – 2011.

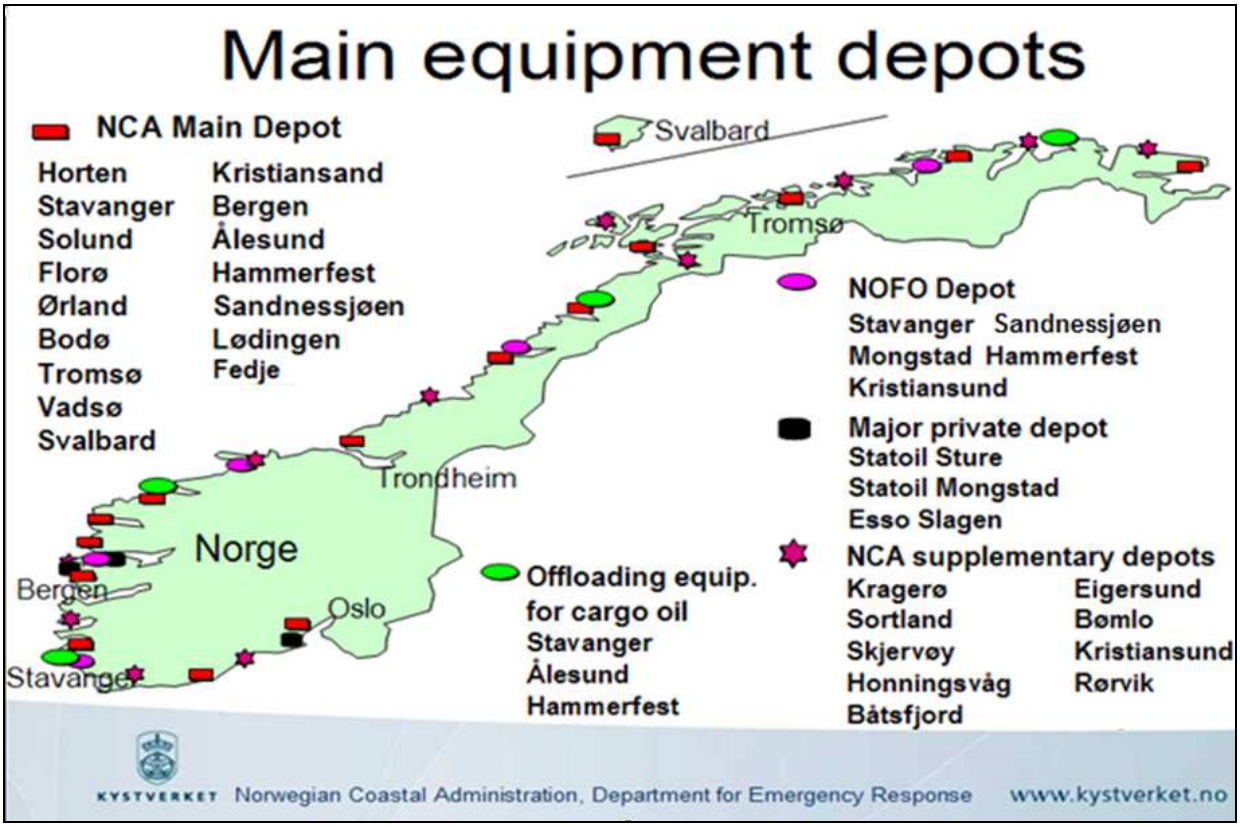

Figure 6-8 National Oil Spill equipment depots in Norway

Private Contingency:

All oil spill response planning requirements are given directly to the operating oil companies. In order to receive a licence to operate, operators are required to have a skilled emergency oil spill organisation and emergency preparedness plans based on environmental risk assessment. The Climate and Pollution Agency may in particular cases stipulate further requirements with regard to the establishment of this emergency preparedness (AR Sec. 64, 66 and 67).

There are no official requirements from the authorities regarding oil spill preparedness to NOFO. NOFO has in cooperation with the operating companies organized oil spill preparedness for all the offshore installations on the shelf and coastal zone.

NOFO preparedness plans is located on the NOFO web site: (http://www.oljevernportalen.no/NOFO/index.htm). NOFO preparedness planns includes all the preparedness plans from the individual offshore installations detailing the industry's liability in event of a major oil spill at an installation.

NOFO recovery equipment and operative specialists are placed on standby vessels and on depots along the Norwegian coast. To secure quick and optimal response, NOFO recovery equipment is moved between the different oil spill regions and depots in correlation with ongoing offshore activity Figure 6-9.

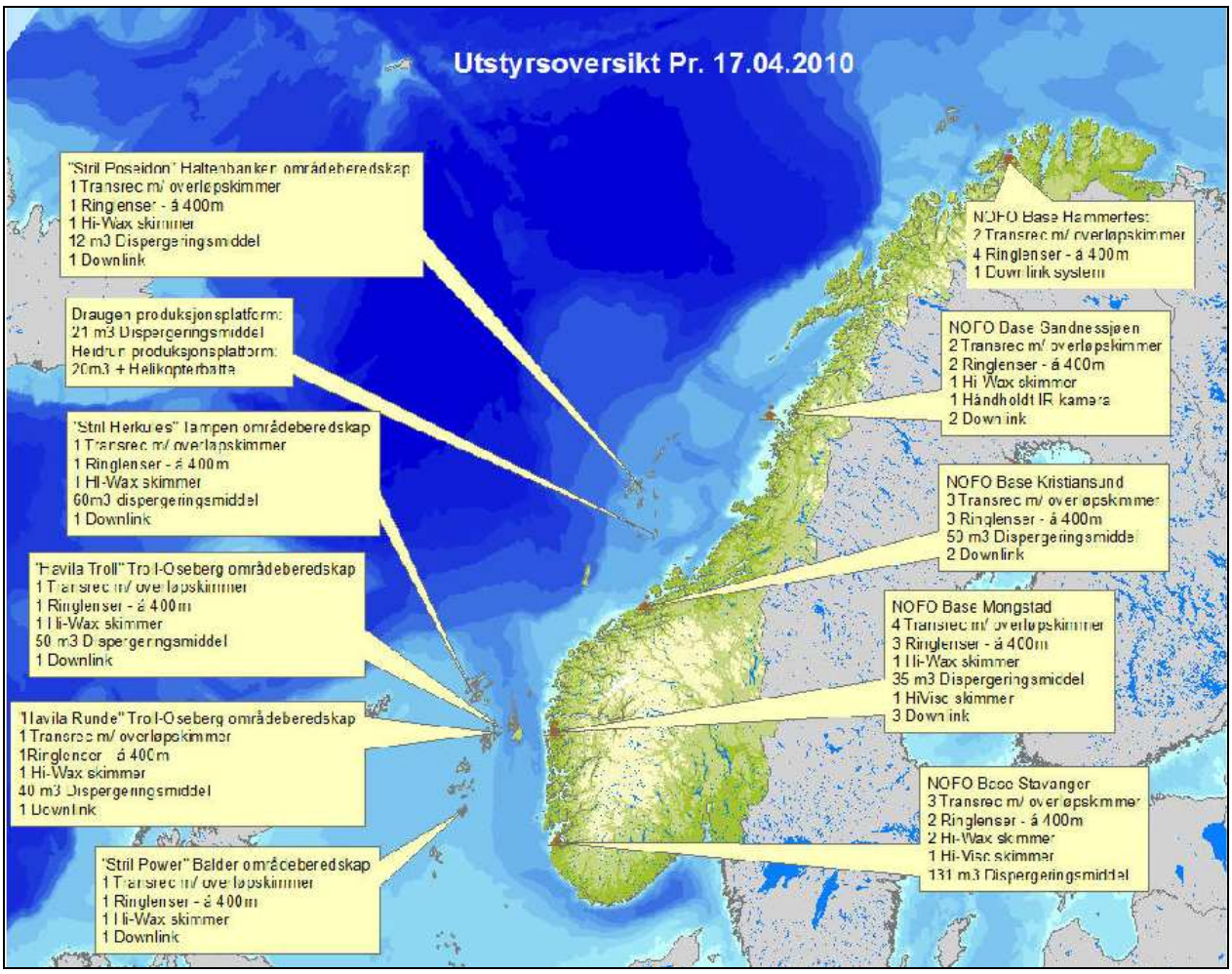

Figure 6-9 Updated map of oil spill equipment placed on standby vessels and onshore bases.

In the event of an emergency situation NOFO shall be notified by the responsible party. NOFO will then deploy an operational staff and estimate the required amount of oil recovery resources. NOFO also gives start-up signals for already contracted monitoring programs and an environmental effect study. During an oil spill response action NOFO will develop and maintain situation picture of the accident using oil drift monitoring, weather and oil drift forecasts to optimise the use of oil spill recovery equipment. Should the oil come too near to the coast requiring beach cleanup, NOFO has an agreement with municipals to provide assistance. NOFO can also support the municipal oil spill organisation with a group of 50 near-shore cleanup specialists.

Technical and operational cooperation exists between NOFO and NCA on issues of joint interest:

- Standards, e.g. HSE manual for oil spill response operations
- Exercises, e.g. oil-on-water exercise
- Projects for technical and operational development of the preparedness e.g.
    - Shoreline clean-up planning system
    - Equipment projects
    - Response methods

Training and Exercises

NCA has the responsibility of building and maintaining competence for the national oil spill preparedness. NCA gives educational training and exercises to internal and external response organisations and personnel. The Pollution Control Act of 1981 regulates the training and exercise activities for the Norwegian government, municipal and industry. The NCA establishes the yearly exercise programme, which consists of international and national exercises. The exercises are designed differently for each organisation. For 2010 the programme includes 2 international exercises, 3 large national exercises, 11 "IKLØ exercises". and 13 internal exercises involving governmental depot equipment and personnel.

The oil companies and NOFO have frequent training and exercises in accordance with the agreements of operations. The following exercises are executed:

- Unannounced drills
- Tabletops
- Deployment for facilities/vessels that own/operate response equipment
- Full-scale exercises

Full scale exercises are often carried out in order to train on challenging scenarios, for instance oil spills from exploration drilling near to shore. Full-scale exercises include NOFO, NCA (by Coast guard) and IUA oil spill equipment and personnel. Full scale exercises are supervised by the authorities.

Oil on water exercise: NOFO organise every year a so called "Oil on water" exercise where NOFO and NCA (by Coast guard) participate to train, measure and develop offshore preparedness on real oil spills. Manufactures of oil spill equipment are invited to test new or improved offshore oil spill equipment and to advance new recovery techniques. Reference to the NOFO web site[5]

[5] http://www.nofo.no/modules/module_123/proxy.asp?D=2&C=14&I=326

In the U. S., MMS in section 30 CFR 250.203, 30 CFR 250.204, and 30 CFR 254, requires that an Outer Continental Shelf (OCS) block lessee submit an Oil Spill Contingency Plan (OSCP) to MMS for approval when or prior to submitting an Exploration Plan (EP) or Development Operations Coordination Document (DOCD). In order to facilitate this requirement in the Gulf of Mexico OCS Region, an operator may submit a regional plan covering all of their Gulf OCS operations. The approved regional OSCP is then referenced when EP's or DOCD's are submitted. Additionally, certain site-specific, oil-spill-response information is required to accompany a plan when a regional OSCP is referenced. An operator may elect to include, or the MMS may require inclusion of, a site-specific OSCP in an EP or DOCD when the approved regional OSCP does not provide adequate oil-spill protection. All regional and site-specific OSCP's are required to be reviewed and updated annually, and all modifications of an OSCP are submitted to MMS for approval.

The Environmental Protection and Response Plan portion of the OSCP outlines the availability of spill containment, and cleanup equipment and trained personnel. It must ensure that full response capability can be deployed during an oil-spill emergency. The plan includes specification for appropriate equipment and materials, their availability, and the time needed for deployment. The plan must also include provisions for varying degrees of response effort, depending on the severity of a spill.

The Oil Pollution Act of 1990 requires that spill-response plans identify and ensure the availability of private personnel and equipment necessary to respond to a worst case discharge. For exploratory or development drilling operations, the size of the worst case discharge scenario is the daily volume possible from an uncontrolled blowout. This scenario must discuss how to respond to the well flowing for 30 days as required by 30 CFR 254.26(d)(1)

The response capabilities must be provided by an Oil Spill Response Organization (OSRO) recognized by the USCG.

Oil Spill Response Organization (OSRO): The Oil Pollution Act of 1990 (OPA 90) amended the U.S. Federal Water Pollution Control Act (FWPCA) to require the preparation and submission of response plans by the owners or operators of oil-handling facilities. An owner or operator of such a facility is required to submit a response plan that, among other things, identifies and ensures by contract, the availability of private personnel and equipment necessary to remove, to the maximum extent practicable, a worst case discharge (WCD, - including a discharge resulting from fire or explosion), and to mitigate or prevent a substantial threat of such a discharge.

The USCG developed an oil spill removal organization (OSRO) classification program so that facility response plan holders could list OSROs in response plans in lieu of providing extensive detailed lists of response resources if "…the organization has been classified by the Coast Guard and their capacity has been determined to equal or exceed the response capability needed by the [plan holder]…."

This voluntary program provides a measurement of the degree of capability of an OSRO using variables such as the amount and type of "core equipment", its geographic location, and the OSRO's degree of control over its response resources (whether the resources are owned or

contracted). The core equipment includes boom, recovery, storage, and support equipment such as response vessels and response personnel.

OSROs may receive classifications for four different spill sizes (Maximum Most Probable Discharge (MMPD), Worst Case Discharge (WCD) Tier 1, WCD Tier 2, and WCD Tier 3) in six different operating areas (Rivers /Canals, Inland, Great Lakes, Near Shore, Offshore and Open Ocean).

The MMS recognizes and accepts the USCG OSRO Classification to meet their OSCP requirements. OSROs are under contract by the operators to provide services as described by their classifications. However it is the operators' ultimate responsibility to ensure personnel, material and equipment are available for any response operations. The OSRO classification guidelines are a tool to assist them in demonstrating the government that personnel, material and equipment are available. OCS operators must provide contractual agreements with OSROs as part of the OSCPs,

Rapid response in the critical early stages of a spill is essential for a successful response. There are several large OSROs in the U.S with nationwide coverage.

The U.S. Exercise Program (PREP)

The PREP was developed to establish a workable exercise program which meets the intent of the Oil Pollution Act of 1990 (OPA 90). The PREP is a unified federal effort and satisfies the exercise requirements of the Coast Guard, the Environmental Protection Agency (EPA), the Research and Special Programs Administration (RSPA), the Office of Pipeline Safety, and the Minerals Management Service (MMS).

PREP mandates that the following exercises are executed:

- Qualified Individual (QI) notifications
- Unannounced drills
- SMT tabletops (including a "worst case" scenario once every three years)
- On-site equipment deployment for facilities that own/operate response equipment

The operators are required to train response team members in spill response methods. The Spill Response Operating Team members who are responsible for operating response equipment must attend hands on training classes at least annually. This training must include the deployment and operation of the equipment that they will use. Those responsible for supervising the team must be trained annually in directing the deployment and use of the equipment. In addition, the operator is required to provide annual training to the Spill Response Management Team including the Spill Response Coordinators and the operator's designated Qualified Individual. The Qualified Individual is the representative of the owner or operator of an OCS facility that has been authorized by the owner/operator to obligate funds and authorize spill removal actions. The required training includes instruction on all responsibilities that the Spill Management Team or Qualified Individual may need to perform their duties, including deployment strategies, the operational and logistical requirements of response equipment, required spill response reporting procedures, and prediction of spill movement.

MMS conducts unannounced drills to test the ability of oil and gas and pipeline operators to properly respond to an oil spill by using the procedures and resources in their MMS approved Oil-Spill Response Plans. During these exercises, a MMS monitoring team presents a spill scenario involving one or more of the operator's facilities to the operator and then observes the operator's designated Spill Management Team's (SMT) response to the spill scenario. The SMT is a group of personnel identified to staff the appropriate organizational structure to manage spill response implementation in accordance with the response plan. SMT could be an internal group or a contracted third party.

The drills are evaluated using the National Preparedness for Response Exercise Program guidelines. At the conclusion of a drill, the MMS monitoring team discusses with the SMT the strong and weak areas of the response. A written report with the complete documentation of the exercise must be submitted to MMS within 15 days.

MMS requires additional exercises from the operators, such as annual Spill Management Team "table top" exercises. annual equipment deployment exercise, and notification exercises. The operator must notify MMS at least 30 days prior to these exercises occurring. This notice provides an opportunity for MMS to witness the exercise or to request changes in the frequency, location of the exercise, or equipment to be deployed and operated.

6.5 RESPONSE STRATEGY

In summary, the Norwegian oil spill response is mainly based on a mechanical/physical recovery, but the use of dispersants is an option if a Net Benefit Environmental Analyses (NEBA) shows that this is more effective. Other methods as in situ burning and bioremediation have been used in a few occasions. In the U.S. in general, spill cleanup techniques fall into six categories including, but not limited to: mechanical/physical recovery, in situ burning, bioremediation, dispersant, natural remediation, and additives such as herding agents and polymers.

In Norway, in general the recovery response strategy is to operate recovery as close to the source of the spill as possible to reduce further pollution and achieve the best net environmental benefit. The preparedness is planned and organised in a 5 barrier system. Barrier 0 is the sum of technical and organizational safety barriers to prevent blowout and eventuality minimize blowout rates. Barrier 1 is the first oil spill barrier to be deployed as close as feasible to the source. Barrier 2 is the open sea barrier, and its strategy is to be effective in the area between barrier 1 and coastal waters. Cording to OLF/NOFO 2007 standard, barrier 1 and 2 must be able to handle the dimensional spill rate. Barrier 3 operates in costal waters. Beach cleaning operations is known as barrier 4. The barrier principles are illustrated in Figure 6-10.

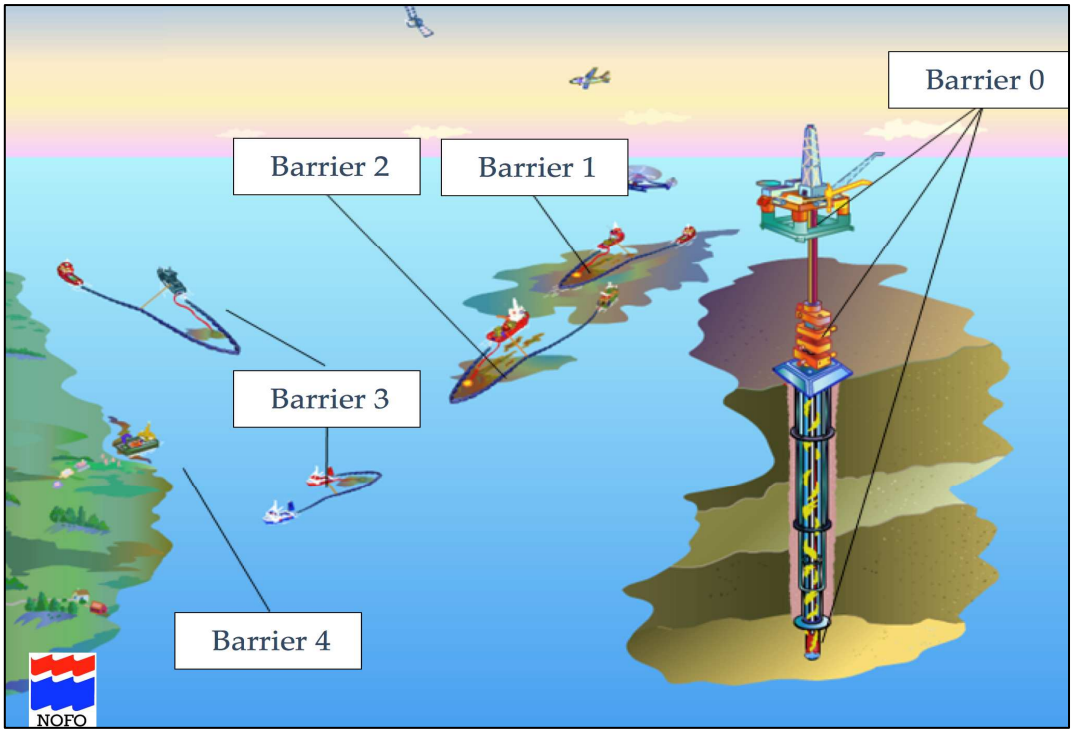

Figure 6-10 The 5 barrier system of offshore oil spill prevention and recovery.

The overall priority for response actions:

- Life, health and safety
- Natural resources
- Economic interests

Different methods, both mechanical and dispersants are available strategies based on net environmental benefit. Norwegian oil spill response is mainly based on a mechanical/physical recovery. The determining factors in method selection usually depend on the type of product (oil) spilled, current state of product, size of the incident, location, weather, site impacts and net environmental benefit evaluations.

The main principle is that the use of dispersants must be a pre-approved cleanup strategy in the protection and response plan by Klif, but the use of dispersants is an option in an oil spill operation, if a NEBA shows that the use of dispersants is a more effective method than mechanical/physical recovery. In this process, the responsible party has to document that the use of dispersants has a net environmental benefit (Pollution control act Sec. 19) and has to apply for permission to use this from the NCA.

Development of new dispersants and more efficient ways of deployment may open for more use off dispersants in the future.

In the U.S., a number of cleanup techniques are available for response to an oil spill. Single or multiple techniques may be utilized in abating a spill. The determining factors in method selection usually depend on the type of product spilled, current state of product, size of the incident, location, weather, political considerations, and site impacts.

In general, spill cleanup techniques fall into six categories including, but not limited to: mechanical/physical recovery, in situ burning, bioremediation, dispersant, natural remediation, and additives such as herding agents and polymers, etc.

Weather and other circumstances permitting, every effort is made to collect oil as close as possible to the source of the spill (in the case of a grounded tanker). Even when oil is spreading on a water surface, collection from water is preferable to coastal cleanup.

Dispersants: Section 4201(a) of the Oil Pollution Act of 1990 require the preparation of a "schedule" of dispersants, other chemicals, and other spill mitigating devices and substances, if any, that may be authorized for use on oil discharges. EPA prepares and maintains this schedule, known as the NCP Product Schedule. Vendors, response personnel, other federal agencies, state agencies, and the public request and use Product Schedule information. The listing of a product on the NCP Product Schedule does not constitute approval of the product[6].

The NCP Subpart J - Use of Dispersants and Other Chemicals, requires RRTs and Area Committees to address, as part of their planning activities, the desirability of using appropriate dispersants, surface washing agents, surface collecting agents, bioremediation agents, or miscellaneous oil spill control agents listed on the NCP Product Schedule, and the desirability of using appropriate burning agents. It requires regional and Area Plans to, as appropriate, include applicable preauthorization plans and address the specific contexts in which such products should and should not be used.

In RRT VI (includes Texas and Louisiana) the use of dispersants to mitigate offshore oil spills has become a proven and accepted technology and, under certain conditions, more effective than mechanical response in removing oil from the surface. Within the Gulf region, an operational dispersant capability has been developed. MMS regulations require operators of offshore facilities to maintain a dispersant plan.

RRT VI has developed guidelines for dispersants use including pre-authorization for their use to the FOSCs under specific circumstances. The FOSC must consult with the RRT under any other circumstance not covered by the pre-approval document[7].

[6] The NCP Product schedule can be found at: http://www.epa.gov/emergencies/docs/oil/ncp/schedule.pdf
[7] RRT VI Pre-approval documents can be found at:
http://www.epa.gov/region06/6sf/respprev/rrt/rrt_pre_approval_documents.htm

6.6 PREPAREDNESS CAPACITY

In Summary Oil spill response equipment recovery capacity is calculated on different assumptions. In Norway recovery capacity is specifically set by calculation and modelling and varies a lot between seasons. In some cases the oil recovery systems is reduced to zero capacity. In the U. S. to calculate the effective daily recovery capacity of the response equipment to contain and recover the worst case discharge multiply the manufacturer's rated throughput capacity over a 24-hour period by 20 %.

Neither in Norway nor in the U. S., the functions and capacity of the oil spill response equipment are checked or certified in a standardised manner by a third party.

In Norway, to calculate the oil recovery capacity needed the oil company have to provide a blowout rate and duration matrix based on a blowout and kill simulations. For an exploration well, oil spill recovery capacity is then based on weighted oil spill release rate and the weighted duration of a blow out scenario. For an oil field development, oil spill recovery capacity is based on the 90 percentile oil spill release rate and weighted duration.

The OLF/NOFO 2007 guidelines describe the methodology to calculate and model the number of offshore recovery systems required for a specific activity. A method standard has been set defining an oil spill recovery capacity of 2400 Sm^3/day during perfect recovery conditions for a standard NOFO oil recovery system. This recovery capacity is based on the NOFO standard for recovery systems (http://www.nofo.no/stream_file.asp?iEntityId=785) and is for technical recovery rates, operational delays and time for emptying recovery oil tanks.

The general principle is that Barrier 1 and Barrier 2 shall have a capacity to handle the amount of emulsified oil reaching the barriers (i.e the spill rate adjusted by oil weathering properties after 2 hours on the sea and after 12 hours). Barrier 2 is also adjusted for the actual efficiency of barrier 1 based on wave height and light conditions.

Oil drift modeling then gives amount of potential oil in the barrier 3 and barrier 4, taken into account the efficiency of previous barriers. The methodology of modeling oil recovery capacity is under development as better modeling tools are capable of modeling the actual oil drift along with efficiency of response arrangements (the OSCAR / OS3D model).

In the U. S, oil recovery capacity is calculated using the potential Worse Case Scenario (WCD) release, and then, based on that release, amount of equipment needed to respond to the WCD is calculated, then multiplied by 20%. 30 CFR §254.44 (MMS regulations) and 40 CFR 112 (National Contingency Plan) describe how to calculate the WCD, 30 CFR §254.44 (MMS regulations) how to calculate oil spill recovery capacity.

30 CFR 254.44 Calculating response equipment effective daily recovery capacities.

(a) You are required by §254.26(d)(1) to calculate the effective daily recovery capacity of the response equipment identified in your response plan that you would use to contain and recover

your worst case discharge. You must calculate the effective daily recovery capacity of the equipment by multiplying the manufacturer's rated throughput capacity over a 24-hour period by 20 percent. This 20 percent efficiency factor takes into account the limitations of the recovery operations due to available daylight, sea state, temperature, viscosity, and emulsification of the oil being recovered. You must use this calculated rate to determine if you have sufficient recovery capacity to respond to your worst case discharge scenario.

(b) If you want to use a different efficiency factor for specific oil recovery devices, you must submit evidence to substantiate that efficiency factor. Adequate evidence includes verified performance data measured during actual spills or test data gathered according to the provisions of §254.45 (b) and (c).

30 CFR 254.47 Determining the volume of oil of your worst case discharge scenario.

You must calculate the volume of oil of your worst case discharge scenario as follows:

(a) For an oil production platform facility, the size of your worst case discharge scenario is the sum of the following:

(1) The maximum capacity of all oil storage tanks and flow lines on the facility. Flow line volume may be estimated; and

(2) The volume of oil calculated to leak from a break in any pipelines connected to the facility considering shutdown time, the effect of hydrostatic pressure, gravity, frictional wall forces

and other factors; and

(3) The daily production volume from an uncontrolled blowout of the highest capacity well associated with the facility. In determining the daily discharge rate, you must consider reservoir characteristics, casing/production tubing sizes, and historical production and reservoir pressure data. Your scenario must discuss how to respond to this well flowing for 30 days as required by § 254.26(d)(1).

40 CFR 112 Attachment D–I—Methods To Calculate Production Volumes for Production Facilities With Exploratory Wells or Production Wells Producing Under Pressure

The owner or operator of a production facility with exploratory wells or production wells producing under pressure shall compare the well rate of the highest output well (rate of well), in barrels per day, to the ability of response equipment and personnel to recover the volume of oil that could be discharged (rate of recovery), in barrels per day. The result of this comparison will determine the method used to calculate the production volume for the production facility. This production volume is to be used to calculate the worst case discharge planning volume.

6.7 REFERENCES

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LEASING OIL AND NATURAL GAS RESOURCES – Outer Continental Shelf - Minerals Management Service

Incident Command System/ Unified Command (ICS/UC) - Technical Assistance

Document - THE NATIONAL RESPONSE TEAM

Code of Federal Regulations (CFR) title 30 PART 250--OIL AND GAS AND SULPHUR OPERATIONS IN THE OUTER CONTINENTAL SHELF

Code of Federal Regulations (CFR) title 30 PART 254--OIL-SPILL RESPONSE REQUIREMENTS FOR FACILITIES LOCATED SEAWARD OF THE COAST LINE

NPS Product Schedule:

http://www.epa.gov/emergencies/docs/oil/ncp/schedule.pdf

RRT VI Pre-approval documents:

http://www.epa.gov/region06/6sf/respprev/rrt/rrt_pre_approval_documents.htm

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