

Comparing the Offshore Drilling Regulatory Regimes of the Canadian Arctic, the U.S., the U.K., Greenland and Norway

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June 2011



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Acknowledgements

This report was prepared by the Pembina Institute for the National Energy Board, who supported this effort. The work presented in this report represents the best efforts and judgments of its authors based on the information available at the time this report was prepared. Any opinions, findings, conclusions, or recommendations are those of the Pembina Institute and do not reflect the views of the National Energy Board, its employees or its administration.

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1. Introduction and Methodology

In the past year there has been a growing focus in many countries on safety and environmental regulation of offshore drilling for oil and gas. The BP *Deepwater Horizon* event of April 20, 2010 triggered concerns about the possible effects if such an event occurred in the Canadian Arctic offshore.

As the regulator for Arctic offshore oil and gas drilling and production, the National Energy Board (NEB) ensures that offshore drilling is conducted safely while protecting the environment. On May 11th, 2010, the NEB announced that it would conduct a review of Arctic safety and environmental offshore drilling requirements (the Arctic Review). The Arctic Review will examine the best available information concerning the hazards, risks and mitigation measures associated with offshore drilling activities in the Canadian Arctic and measures to both prevent and respond to accidents and malfunctions.

To facilitate effective public participation in the Arctic Review, the NEB commissioned this report to compare key aspects of the regulatory regimes in the Canadian Arctic with those in the Greenland, Norway, United Kingdom (U.K.), and the United States of America (U.S.). The report identifies similarities and differences between regulatory regimes, focusing particularly on:

- Overview of regulations and regulatory regimes (Chapter 2);
- Management systems requirements (Chapter 3);
- Drilling and well activities (Chapter 4);
- Facility and drilling system requirements (Chapter 5);
- Requirements for well control (Chapter 6);
- Independent verification of safety (Chapter 7); and
- Oil spill preparedness requirements (Chapter 8).

The report is accompanied by a plain language summary document that identifies key information and highlights from the comparison report.

This chapter introduces the report by providing basic information on the context for offshore drilling in the Canadian Arctic, a brief history of drilling and related activity in this region and a description of the report's scope and methodology. It also includes a list of definitions and abbreviations.

1.1 History of offshore drilling in the Canadian Arctic Ocean

Exploration drilling in Canada's Arctic offshore began in 1972.¹ Since then, approximately 90 wells have been drilled in the Beaufort Sea. In addition, 34 offshore wells have been drilled in Nunavut's High Arctic Islands and another three wells have been drilled in the Eastern Arctic offshore. Most of this activity occurred in the 1970s and 1980s when the combination of increases in fuel prices and federal incentives made the Arctic an attractive place for companies to invest in exploration. All of these wells have been properly abandoned.

Changes in market conditions for oil and gas, the end of government exploration incentives and the absence of infrastructure to ship oil and gas to markets resulted in the withdrawal of companies from exploration drilling in the Arctic offshore during the 1990s. Since 1991, when the National Energy Board took over the regulations of oil and gas exploration and production activities in this area, the only offshore well that has been drilled in Canada's Arctic is the Devon Paktoa C-60 exploration well. It was drilled in the Beaufort Sea during the winter of 2005/06 and was properly abandoned in March 2006.

Exploration activities to date have yielded estimates of the oil and gas reserves in some regions of the Arctic offshore. According to estimates originally published in 2002, the Mackenzie Delta–Beaufort Sea sedimentary basin in the western Arctic, which is the area of primary interest for exploration, contains 680.6 billion litres (5.8 billion barrels) of oil and 1.64 trillion cubic meters (58 trillion cubic feet).² There are also estimates of significant natural gas reserves in the High Arctic.

Exploration interest in the Arctic offshore has increased in recent years. Six significant discovery licences were issued in 2007 and 2008 to three companies exploring in the Beaufort Sea.³ For example, Devon Canada Corporation's Paktoa exploration program declared a significant discovery in October 2007 with the company's announcement that it had found approximately 28 billion litres (240 million barrels) of potentially recoverable oil.⁴ There has also been an increase in the number of active exploration licences in the Mackenzie Delta–Beaufort Sea region. For example, Indian and Northern Affairs Canada issued four exploration licences in 2008 to BP Exploration Company Limited for large blocks in the Beaufort Sea. The successful bids included

¹ Information in this section is based on: National Energy Board, Background: Regulation of Offshore Drilling in the Canadian Arctic (no date); K. Voutier et al., "Sustainable Energy Development in Canada's Mackenzie Delta–Beaufort Sea Coastal Region" *Arctic*, 61 Suppl. 1, (2008) 103-110.

² Voutier et al., 104, citing K.J. Drummond (2002) *Northern Canada distribution of ultimate oil and gas resources*. Available from the Director General, Northern Oil and Gas Branch, Indian and Northern Affairs Canada.

³ Indian and Northern Affairs Canada, "Oil and Gas Rights," <http://www.ainc-inac.gc.ca/nth/og/le/rtis-eng.pdf>

⁴ Indian and Northern Affairs Canada, "Northern Oil and Gas Annual Report 2007", <http://www.ainc-inac.gc.ca/nth/og/pubs/ann/ann2007/ann2007-eng.asp>

a commitment to spend \$1.18 billion on exploration activity.⁵ In February 2011, a call for bids was opened for three additional parcels in the Beaufort Sea and Mackenzie Delta.⁶

⁵ Indian and Northern Affairs Canada, “2007-2008 Beaufort Sea and Mackenzie Delta,” <http://www.ainc-inac.gc.ca/nth/og/rm/ri/bsm/bsm08/index-eng.asp#chp3>.

⁶ Indian and Northern Affairs Canada, “2010-2011 Beaufort Sea and Mackenzie Delta” <http://www.ainc-inac.gc.ca/nth/og/rm/ri/bsm/bsm11/index-eng.asp> .

1.2 About this report

The objective of this report is to compare the regulatory regimes in the Canadian Arctic, the U.S., the U.K., Greenland, and Norway. This report identifies similarities and differences between regulatory regimes and the legislation and regulations for offshore oil and gas drilling activities.

Chapter 2 includes an overview of the regulatory regimes in each jurisdiction and a summary of the similarities and differences between regimes.

Chapter 3-8 includes review of legislation and regulations pertaining to specific topics. Each topic-specific chapter begins with a table comparing components of the regulations in each jurisdiction against each other, with the Canadian Arctic offshore as the reference case. Each chapter summarizes the legislation and regulations in each jurisdiction and provides links to the original source if the reader requires further information.

1.3 Scope of work

The objective for this study, as stated in the NEB’s Request for Proposals, is to provide “a side-by-side comparison of offshore oil and gas drilling regimes” based on “a review of the existing regulatory documents that are available from the regulator or government website.” The NEB confirmed at a project planning meeting that the scope of the jurisdictional review should be limited to statutes and associated regulations enacted by the national governments and should not extend to guidelines, codes of practice, management plans and other similar documents containing standards or procedures that may in some cases be applied to offshore drilling. Territorial, provincial or state-specific regulations were also excluded according to instructions from the NEB. This report reflects this direction on project scope, although it refers to guidelines in some jurisdictions that are mentioned, or incorporated by reference, in legislative provisions. The legislation and regulations reviewed in this report are current as of March 15, 2011. Any changes to the regimes after that date or any upcoming changes were not included in the review.

The offshore regulatory regime in Canada reviewed in this document excludes legislation and regulation specific to the offshore regimes in Nova Scotia and Newfoundland–Labrador (see Figure 1).

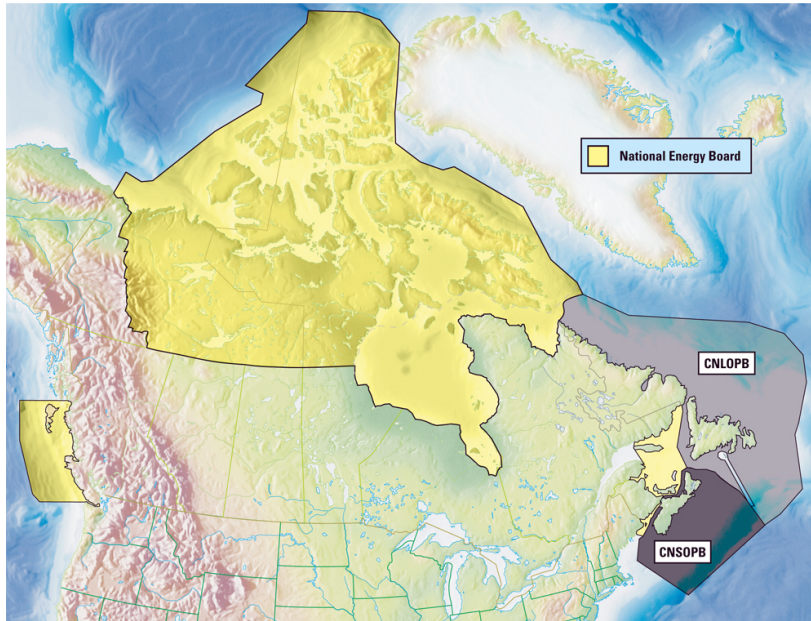


Figure 1: National Energy Board jurisdiction over oil and gas activities⁷

Other aspects of the process of offshore oil exploration, production and transportation, although important, were not included in the scope of this report, such as:

- environmental assessment legislation except where it had implications for oil spill response planning;

⁷ Note: Map is for illustrative purposes only and the boundaries shown are not exact.

- legislation and regulations pertaining to resource disposition;
- regulations relating to transportation or shipment of the resource after production to refineries and markets, or spills occurring during transport of oil;
- financial liability for damages from emergencies and oil spills; and
- well abandonment and decommissioning.

The side-by-side comparison of statutes and regulations provides a consistent basis for reviewing the legal foundations and basic structure of the regulatory regimes in the five countries. When interpreting the findings from this review, however, it is important to note that these regimes have structural differences that may result in certain functions or requirements appearing within the legislative framework in one country and in non-legislated documents in another. For example, a country with a highly prescriptive and detailed legislative regime may include specific requirements for standards, procedures and management practices (e.g., tools for risk assessment and management) in statutes or regulations. In contrast, a country with a performance-based or goal-based system may leave some or all of these details to be defined through management systems or codes of best practices that are spelled out in guidelines developed by government or industry or in the management plans of operators. The legislative component of these regimes may focus on requirements for the development, monitoring and enforcement of the management systems that are needed to ensure that performance standards are achieved. A comparison of regulatory requirements within the legislative framework may not, therefore, reveal all elements of the interconnected regulatory and management systems for offshore drilling that ultimately determine how responsibilities and functions are defined and discharged in operational terms.

1.4 Definitions and abbreviations

1.4.1 Definitions

Accumulator: Used in a hydraulic system to store energy or dampen variations in pressure.

Barrier: The term "barrier" and the concept of a barrier are not used in all jurisdictions. In Canada's National Energy Board regulations a well barrier is defined as any "fluid, plug or seal that prevents gas or oil or any other fluid from flowing unintentionally from a well or from a formation into another formation."⁸ Barriers can also have a broader meaning in terms of safety, which includes operational and organizational measures that reduce the probability of harm.

Blowout preventer (BOP): A valve on top of a well that can be closed if there is a loss of control of formation fluids.

Borehole: See casing string.

Casing: See well casing.

Casing shoe: The bottom of a casing string; often includes the cement and equipment at the bottom of a casing string.

Casing string: The entire length of all the joints of casing in the well. The hole drilled for the casing string must be wide enough to fit the casing, allowing room for cement between the casing and wall of the hole (also called borehole).

Cement plug: A carefully balanced plug of cement slurry that is placed in the wellbore. Plugs can be used for hydraulic isolation and are often considered a provision of a secured platform.

Cementing: It provides strength to the borehole and helps to isolate dangerous high-pressure zones between the well on the ocean floor and the surface. Cementing also protects the casing from corrosion from formation fluids. Cementing is performed by inserting cement slurry (made of water, cement and other additives) inside of the casing and out into the annulus (the void between the casing and the borehole) through the bottom of the casing string. Some regulations specify the wait time between cementing and resuming operations, so that the cement has time to harden sufficiently.

Choke line: A line that directs fluid from an outlet on the BOP stack to the flaring system and a kill line directs fluid leads from an outlet on the BOP stack to the rig pump.

Choke manifold: A set of high-pressure valves and associated piping to which well flow is directed and fluid pressure is reduced.

⁸ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations* 2009, SOR/2009-315, Section 1, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

Control system: Control systems refer to the location, type, and strength of the equipment that would be used to control the well in case of an emergency. Redundancy in well control equipment is required from some jurisdictions, to provide additional levels of control of the equipment. Some jurisdictions require that well control equipment be capable of being remotely operated or have additional automatic control options.

Christmas tree: An assembly of valves, spools and fittings that control the flow into and out of an oil and gas well.

Cuttings: Small pieces of rock that are loosened as a result of the drilling action from a drilling bit. Cuttings composition is monitored by a drilling fluid system, which has the ability to screen out cuttings from the drilling fluid.

Diverter: Used to direct shallow gas away from the facility or personnel through side outlets (diverter line).

Drilling fluid (mud) control system: This system manages the slurry and mud used during drilling operations. More specifically, a drilling fluid control system controls the type and amount of solids used, and the chemical properties, circulation and temperature of drilling fluids.

Duty holder: Described in U.K. *Offshore Safety Case Regulation* (OSCR) as the person (whether the owner or the operator of an installation) on whom duties are placed by OSCR in respect of installations, particularly to prepare the safety case.

Dynamic positioning systems (DPS): These systems enable floating offshore drilling rigs to maintain their position over an offshore well without the use of fixed mooring anchors. Typically, thrusters, located in the hulls of the drilling rig, are automatically activated by a sensing system to maintain the rig's location.

Emergency shutdown systems (ESD): These are intended to reduce the consequences from uncontrolled flooding, escape of hydrocarbons or fire in an area with hydrocarbons or other hazards associated with offshore drilling and production. Typically, an ESD shuts down part of an offshore installation's systems and equipment, isolates hydrocarbon inventories and stops hydrocarbon flow, isolates electrical equipment, prevents the escalation of events, depressurizes the system, controls emergency ventilation and closes watertight and fireproof doors.

Emergency shutdown valve: Also referred to as a shutdown valve, this actuated valve stops the flow of hazardous fluids after a dangerous event is detected.

Fire and gas system: This system detects, alerts and mitigates fire, heat, smoke and toxic/flammable gas releases using a variety of sensors. Typically on offshore installations, a fire and gas system triggers an emergency shutdown system and operates a sprinkler system in open areas and clean agents in enclosed areas.

Formation fracture gradient: The pressure required to cause a rock formation, at a given depth, to hydraulically fracture.

Formation fluids: Any fluid that occurs in the pores of a rock.

Formation (flow) test: See well production testing.

Goal-oriented regulatory system: A hybrid approach that combines features from both performance-based and prescriptive regulatory systems.

Hazardous area classification: Hazardous area classifications, developed by various standards organizations, are applied to equipment to describe the equipment's suitability for use in certain hazardous conditions. The design criteria for hazardous area classification typically take into account "the probability of an explosive mixture being present, the type of combustible material and the spark energy or temperature required to ignite the combustible material likely to be present."⁹

Independent verification of fitness: Regulatory provisions for independent verification vary widely, hindering any precise definition for this element of offshore oil and gas regulation. In general, they provide for some third-party, private-sector expert or firm, defined in the regulations, to review a facility's planned or instituted safety features, whether structural, equipment, or operational, to ensure they meet some set of regulatory safety objectives of the larger regulatory regime. Examining examples of such systems gives the best, concrete sense of their functions and details.

Kick: A flow of formation fluids into the wellbore during drilling operations. The kick is caused when the pressure in the wellbore is less than that of the formation fluids.

Management system: A framework of plans, processes and procedures used to ensure that an offshore facility will fulfill the regulatory requirements concerning health, safety and the environment, and meet safety and environmental objectives such as avoiding and preparing for accidents and emergencies.

Marine riser: A large-diameter pipe used by floating drilling units to connect the subsea blowout preventer to the surface rig and return mud to the surface. The riser is also considered a temporary extension of the wellbore to the surface. The marine riser houses the drill bit and drill string and must be flexible to deal with movement of the drilling unit.

Offshore installation: An installation that is located at an offshore drill or production, and includes accommodation and diving installations.¹⁰

Performance-based regulatory system: Also referred to as goal-based, this regulatory system identifies functions or outcomes for regulated entities but allows them considerable flexibility to determine how they will undertake the functions and achieve the outcomes.

Pore pressure: The pressure of fluids contained in the pores of a hydrocarbon reservoir.

Prescriptive regulatory system: This regulatory system sets specific technical or procedural requirements that must be complied with by regulated entities.

⁹ J.J. Hinds, "Hazardous Area Classifications and Definitions," (paper presented at the SPE/IADC Drilling Conference, Dallas, Texas, February 28, 1988).

¹⁰ Government of Canada, *Canada Oil and Gas Installations Regulations* SOR/96-118, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-118/index.html>.

Rams: Rams are used to close off the pipe in case of emergency. There are four types of rams: pipe, blind, shear and blind-shear.

Riser margin: The difference in hydrostatic pressure in the riser mud column and the surrounding sea water. In the case of a riser leak or disconnection, the riser margin will be maintained if there is sufficient hydrostatic pressure from the remaining drilling or completion fluid. This is necessary to maintain well control and prevent a severe kick and hole collapse.

Safety Environmental Management System (SEMS): See management system.

Safety case: See management system.

Subsurface safety valve: Subsurface safety valves are placed in the upper wellbore to provide emergency closure of the well in the event of an emergency. They can be either surface controlled or subsurface controlled.

Well design: Well design typically considers the safety, equipment and testing requirements that an operator must plan for before drilling the well. Most of the well design regulations require the operator to consider, among others, pore pressure, drilling fluids weights, casing setting depths and geological formations.

Well casing: A steel pipe placed in a well during drilling which lines the well to prevent walls from caving in, to prevent any escape of fluids and to allow the extraction of petroleum during well production. The casing must be designed to withstand a number of forces and stressors as demonstrated through quality parameters such as collapse resistance and burst pressure.

Well production testing: Determining the potential of the well to yield hydrocarbons. It involves gathering pressure data and fluid samples from a formation. It is also called a formation test or formation flow test.

1.4.2 Acronyms

Acronym	Meaning	Relevant Jurisdiction
APM	Application for Permit to Modify	U.S.
REET	Regional Environmental Emergencies Team	Canada
BAT	Best Available Techniques	U.K.
BEP	Best Environmental Practice	U.K.
BMP	Bureau of Minerals and Petroleum	Greenland
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement	U.S.
BOP	Blowout preventer	U.S.
CFR	Code of Federal Regulations	U.S.
COGOA	<i>Canada Oil and Gas Operations Act</i>	Canada
CPSO	Counter Pollution & Salvage Officer	U.K.
CVA	Certified Verification Agent	U.S.

DCR	<i>Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996</i>	U.K.
DECC	Department of Energy and Climate Change	U.K.
DNV	Det Norske Veritas	Norway
DOI	Department of the Interior	U.S.
DPS	Dynamic position system	U.S.
EP	Exploration Plan	U.S.
EPA	Environmental Protection Agency	U.S.
ERP	Emergency Response Plan	Canada
ESD	Emergency shutdown systems	All
EU	European Union	
FEPA	<i>Food and Environment Protection Act 1985</i>	U.K.
FOSC	Federal On-Scene Coordinator	U.S.
HMCG	Her Majesty's Coast Guard	U.K.
HSE	Health, Safety, and Environment	Norway
HSW Act	<i>Health and Safety at Work etc. Act 1974</i>	U.K.
ICP	Independent and competent person	U.S.
IEC	International Electrotechnical Commission	U.S.
INAC	Indian and Northern Affairs Canada	Canada
Klif	Climate and Pollution Agency	Norway
MAR	<i>Offshore Installations and Pipeline Works (Management and Administration) Regulations 1995</i>	U.K.
MCA	Maritime and Coastguard Agency	U.K.
MMS	Mineral Management Service	U.S.
MODU	Mobile offshore drilling units	U.S.
MoU	Memorandum of Understanding	All
NCA	Norwegian Coastal Administration	Norway
NCP	National Contingency Plan	U.S./U.K.
NEB	National Energy Board	Canada
NEC	National Electric Code	U.S.
NFPA	National Fire Protection Association	U.S.
NORSOK	The competitive standing of the Norwegian offshore sector. (NORsk SOKkels Konkuranseposisjon)	Norway
NRCan	Natural Resources Canada	Canada
NRT	National Response Team	U.S.
NTL	Notice to Lessees and Operator	U.S.
OCS	Outer Continental Shelf	U.S.

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OCSLA	<i>Outer Continental Shelf Lands Act</i>	U.S.
OPEP	Oil Pollution Emergency Plan	U.K.
OSCR	<i>Offshore Installations (Safety Case) Regulations 2005</i>	U.K.
OSRO	Oil Spill Response Organizations	U.S.
OSRP	Oil Spill Response Plans	U.S.
OSRSCR	<i>Offshore Installations (Safety Representatives and Safety Committees) Regulations 1989</i>	U.K.
PFEER	<i>Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995</i>	U.K.
PREP	U.S. Exercise Program	U.S.
PSA	Petroleum Safety Authority	Norway
PVP	Platform Verification Program	U.S.
ROV	Remotely operated vehicle	All
RRT	Regional Response Teams	U.S.
SCEs	Safety-critical elements	U.K.
SEMS	Safety and Environmental Management System	U.S.
SOSREP	Secretary of State's Representative	U.K.
U.K.	United Kingdom	U.K.
U.K. HSE	Health and Safety Executive	U.K.
U.S.CG	U.S. Coast Guard	U.S.
WCD	Worse Case Discharge Scenario	U.S.

2. Regulations and Regulatory Regimes

2.1 Summary of differences and similarities

2.1.1 Legislation governing offshore drilling

In the countries reviewed in the research, the scope of legislation governing offshore drilling can include environmental protection, safety, employment standards and work environment, health protection, emergency planning, oil spill response, and liability for accidents. These topics can be regulated either primarily through a single comprehensive statute and associated regulations or through separate statutes that address individual topics. Since there is potential overlap among many of these topics, a single statute focused on offshore drilling may facilitate an integrated approach to regulation that ensures coordination and provides a ‘single window’ to the regulatory system. However, even when regulatory regimes are structured in this way, there are often some statutes of general application (i.e., statutes that are not limited to one type of activity) that also apply to aspects of offshore drilling. Where offshore drilling is regulated through multiple statutes, the efficiency and effectiveness of the regulatory regime can be ensured by measures to coordinate the application of these provisions and enhance the ability of regulated entities and other parties to understand the overall approach to regulation and the specific requirements.

Arctic offshore drilling in Canada is regulated primarily under the *Canada Oil and Gas Operations Act* and regulations under that Act. Other legislation of general application governs some related topics, such as environmental assessment, oil spill response, emergency planning and employment standards. The legal basis for regulation in the other countries ranges from the concentration of legislative authority over all or most aspects of offshore drilling in one Act (e.g., Greenland) to the use of many separate statutes to regulate different aspects of this activity (e.g., Norway). The U.S. and the U.K. each have one principal statute governing offshore drilling and various laws of general application that regulate specific aspects. In countries where several pieces of legislation apply to offshore drilling, the principal regulatory authority may be responsible for coordinating the regulatory regime and developing specific regulations (e.g., Norway’s Petroleum Safety Authority). Other mechanisms for coordination among regulatory authorities are noted below, in Sections 2.1.4-2.1.7.

Table 1: Legislation and regulations specific to offshore drilling

Jurisdiction	Legislation and Regulations Specific to Arctic Offshore Drilling
Canadian Arctic	<i>Canada Oil and Gas Operations Act</i> <i>Canada Oil and Gas Drilling and Production Regulations</i> <i>Canada Oil and Gas Certificate of Fitness Regulations</i>

Regulations and Regulatory Regimes

	<p><i>Canada Oil and Gas Installation Regulations</i></p> <p><i>Canada Oil and Gas Diving Regulations</i></p> <p><i>Canada Oil and Gas Geophysical Operations Regulations</i></p> <p><i>Oil and Gas Spills and Debris Liability Regulations</i></p>
United States	<p><i>Outer Continental Shelf Lands Act and Outer Continental Shelf Reform Act of 2010</i></p> <p><i>Oil Spill Response Act</i></p> <p><i>Comprehensive Environmental Response, Compensation, and Liability Act</i></p> <p><i>Code of Federal Regulations: 30 CFR 250, 254; 33 CFR 140-147; 40 CFR 300; 46 CFR 108-111</i></p> <p><i>National Environmental Policy Act</i></p>
United Kingdom	<p><i>Petroleum Act 1998 and clauses</i></p> <p><i>European Communities Act 1972</i></p> <p><i>The Offshore Petroleum Production and Pipelines (Assessment of Environmental Effects) (Amendment) Regulations 2007</i></p> <p><i>Pollution Prevention and Control Act 1999</i></p> <p><i>The Offshore Petroleum Activities (Oil Pollution Prevention and Control) (Amendment) Regulations 2010</i></p> <p><i>Offshore Safety Act 1992</i></p> <p><i>Health and Safety at Work etc. Act 1974</i></p> <p><i>The Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995</i></p> <p><i>The Offshore Installations and Pipeline Works (Management and Administration) Regulations 1995</i></p> <p><i>Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995</i></p> <p><i>The Lifting Operations and Lifting Equipment Regulations 1998</i></p> <p><i>The Provision and Use of Work Equipment Regulations 1998</i></p> <p><i>The Management of Health and Safety at Work Regulations 1999</i></p> <p><i>The Offshore Installations (Emergency Pollution Control) Regulations 2002</i></p> <p><i>The Control of Substances Hazardous to Health Regulations updated in 2002</i></p> <p><i>Offshore Installations (Safety Case) Regulations 2005</i></p> <p><i>The Noise at Work Regulations 2005</i></p> <p><i>Coastguard Act 1925</i></p> <p><i>Food and Environment Protection Act 1985</i></p>
Greenland	<p><i>Mineral Resources Act</i></p> <p><i>Exploration Drilling Guidelines</i></p>
Norway	<p><i>Petroleum Activities Act</i></p> <p><i>Working Environment Act</i></p> <p><i>Health Personnel Act</i></p> <p><i>Fire and Explosion Protection Act</i></p> <p><i>The Pollution Control Act</i></p> <p><i>The Framework Regulations</i></p>

	<p><i>The Management Regulations</i></p> <p><i>The Information Duty Regulations</i></p> <p><i>The Facilities Regulations</i></p> <p><i>The Activities Regulations</i></p>
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2.1.2 Overall regulatory approach: Prescriptive requirements versus performance-based or goal-based regulation

The regulation of offshore drilling can be situated on a spectrum between prescriptive requirements and performance-based regulation. Many regimes include elements of both approaches. Prescriptive regulation sets specific technical or procedural requirements with which regulated entities must comply. Performance-based or goal-based regulation identifies functions or outcomes for regulated entities but allows them considerable flexibility to determine how they will undertake the functions and achieve the outcomes. Each of these approaches has strengths and limitations. There is evidence of a general increase in the use of performance-based or goal-based regulation because of the greater flexibility for innovation and cost effectiveness when compared with traditional prescriptive requirements. Nonetheless, prescription may be the more appropriate approach where compulsory requirements are needed to ensure compliance with standards, provide greater certainty regarding requirements, and facilitate monitoring and enforcement.

The National Energy Board has adopted a hybrid approach that combines the use of prescriptive and performance-based requirements depending upon which one is considered to be most appropriate. Prescription is used when compulsory means of compliance are desired. Goals are used when circumstances can differ greatly among the regulated companies or where superior outcomes are likely to be achieved through innovation or new technology. Other countries’ systems range from prescriptive to performance-based. The U.S. system is the most prescriptive. Norway’s regulatory regime is mainly performance-based, supplemented with prescriptive elements. The U.K. uses a performance-based approach, referred to as “goal-setting,” that requires companies to continually demonstrate that they are taking measures to minimize the risk of oil and gas releases to ‘as low as reasonably practicable.’ Greenland’s new regime is also performance-based and requires operators to adopt the best international practices. In some performance-based systems, such as the Norwegian regime, non-binding guidelines containing recommended practices are sometimes provided, but regulated entities are permitted to adopt other approaches if they can demonstrate that they are at least as effective in achieving the performance objective.

Table 2: Overall regulatory approach comparison

Jurisdiction	Overall Regulatory Approach
Canadian Arctic Offshore	Hybrid approach that uses prescriptive and performance-based requirements depending upon the circumstance
United States	Mainly prescriptive regulations, often requiring industry standards through regulatory incorporation
United Kingdom	Performance-based approach that requires companies to continually demonstrate

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	that they are taking measures to minimize hazards and risks to “as low as reasonably practicable.”
Greenland	Performance-based; requires the operator to adopt international best practices
Norway	Performance-based approach with non-binding guidelines and recommended standards

Approach to regulations: prescriptive versus performance-based

Approaches to regulation can be characterized as either prescriptive or as performance-based or goal-based. Many regulatory regimes for offshore drilling include elements of both approaches.

Prescriptive regulation sets specific technical or procedural requirements with which regulated entities must comply. The regulatory function focuses on ensuring conformity with specified requirements. Performance-based or goal-based regulation identifies functions or outcomes for regulated entities but allows them considerable flexibility to determine how they will undertake the functions and achieve the outcomes. With this approach, the regulatory role involves defining the standards that companies must meet and using audits and inspections to ensure that they have the management systems in place to achieve the specified performance standards or goals. Each of these approaches has strengths and limitations.

There is evidence of a general increase in the use of performance-based or goal-based regulation because of the greater flexibility for innovation and cost effectiveness when compared with traditional prescriptive requirements.¹¹ This approach allows companies to adapt required programs and procedures to suit the specific business and environment in which they operate. It also encourages innovation and can lead to safer systems and a more proactive approach by companies to identifying issues and assuming responsibility for addressing them. Weaknesses include higher enforcement costs and the potential lack of transparency to the public. Furthermore, it may be difficult to interpret the desired performance levels defined in the regulations. Guidelines or interpretation documents may therefore be useful.

Prescriptive regulation may be more appropriate where specific direction on procedures or technical standards is needed to provide greater certainty regarding requirements and to facilitate monitoring and enforcement. For example, this approach works well to set compulsory design specifications for safety equipment or procedures for incident reporting where requirements should not vary regardless of the circumstances or the location of the facilities. It is particularly applicable where best practices can be clearly defined, there is little need or potential for innovation, and where deviation from requirements could create unacceptable risks to the environment or human health. The main weaknesses of prescriptive regulation are that its inflexibility can impede the introduction of innovative practices and technology and reduce responsiveness to unique or changing circumstances.

¹¹ Det Norske Veritas, *OLF/NOFO – Summary of Differences between Offshore Drilling Regulations in Norway and U.S. Gulf of Mexico*, Rev. 02, Aug. 26, 2010, p. 17.

2.1.3 Offshore regulation in the context of the overall regulatory approach to offshore production

This review looks at offshore drilling activities only. It should be noted that different jurisdictions apply different processes before they permit drilling in their waters. The approach taken to regulating drilling should therefore be viewed in the context of the environmental and social assessment processes undertaken before exploration and production. Governments apply a variety of strategic assessments to determine which areas to open up to licensing for hydrocarbon exploration. Even the strictest regimes and latest technology cannot eliminate the possibility of a spill, with human error to blame for the majority of incidents. Risk-based management systems should demonstrate that the risks have been reduced to an agreed level. However this still leaves the possibility, albeit very unlikely, that a low-probability, high-impact event may occur. This is why the decision is made not to expose highly sensitive or important ecosystems to the risks associated with drilling for hydrocarbons in some cases. For example, Norway continues to have a moratorium on drilling in its Lofoten islands due to their significance for the fishing industry.

The type of regulatory regime will also determine the resources, capacity and expertise required by the regulator. More flexible performance-based regimes require interpretation of the safety cases made by operators. The balance between regulator inspection and independent verification will inform the resources needed. Changes to regulatory frameworks should trigger reviews of the form and function of regulatory teams in order to ensure they continue to be effective and aligned with the overall approach.

2.1.4 Division between responsibility over resource disposition and revenue and the regulation of health, safety and the environment

In addition to the regulatory responsibilities for environmental protection, health and safety, and related issues that are the focus of this report, government authority over offshore drilling includes the leasing to companies of legal rights to explore for and develop offshore oil and gas (often referred to as rights issuance or rights disposition) and the collection of royalties from the development of these government-owned resources. The mandates of departments and agencies with authority in these areas often include the explicit or implicit objectives of promoting or facilitating offshore oil and gas activity and maximizing revenue flows to government. As a result, concerns have sometimes been raised that these departments and agencies may find themselves with competing objectives and potential conflicts of interest if they are also assigned regulatory authority over environmental protection, health and safety and other areas that sometimes result in constraints on drilling activities. The perceived risk is that the emphasis on promoting development and generating revenue may result in pressures within these departments and agencies to relax regulatory requirements. These concerns have led to the separation of these functions in some jurisdictions.

There is a clear separation of responsibility in Canadian Arctic offshore between regulation of drilling and the issuance of oil and gas rights (e.g., exploration, significant discovery and production licences) and the collection of royalties. The separation between the regulator and the resource disposition and revenue collecting authority is also found in Norway and in the United Kingdom (where these roles were separated after the *Piper Alpha* disaster in 1988). The U.S. is

moving to separate these roles after the *Deepwater Horizon* blowout. Greenland’s new regime combines these functions in a single agency.

2.1.5 Division of authority among regulatory bodies

The enforcement and administration of regulations governing offshore drilling is the responsibility of government departments and specialized agencies. Operational and administrative functions within the regulatory regime can be concentrated in one specialist entity or divided among several bodies. This division sometimes reflects the underlying structure of legislation (described above), although a single body may be given authority to administer multiple statutes and regulations. To ensure a coordinated regulatory approach to offshore drilling, it is common to assign primary responsibility to one department or agency. It is rare, however, for all aspects of regulation to be administered by a single body.

In Canada, authority to regulate Arctic offshore drilling lies primarily with the National Energy Board (NEB). In the Canadian Arctic offshore, the NEB administers the pertinent acts and regulations for oil and gas exploration and production activities. A small number of other departments and agencies also have authority over aspects of offshore drilling and related issues. Most of the other countries also have one agency with primary responsibility for the principal regulatory functions that plays a coordination role with other regulators. Norway’s primary regulator is the Petroleum Safety Authority (PSA), which administers the application of multiple statutes to offshore drilling, but there are two other regulators with independent authority over aspects of health, safety, and environmental regulation of the industry. The U.S. institutional structure is currently in transition, with broad authority currently given to Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) pending further restructuring. The Environmental Protection Agency and the U.S. Coast Guard are also involved in specific aspects of offshore regulation and related issues. In the United Kingdom, the Department of Energy and Climate Change is responsible for the licensing, exploration and development of oil and gas whereas the Health and Safety Executive Offshore Division is responsible for regulating the risks to health, safety and the environment arising from work activity. Greenland has one agency, the Bureau of Minerals and Petroleum (BMP), that is responsible for all aspects of offshore drilling.

Table 3: Main regulatory bodies in each jurisdiction

Jurisdiction	Main Regulatory Bodies
Canadian Arctic Offshore	National Energy Board
United States	Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) Environmental Protection Agency (EPA) U.S. Coast Guard (USCG)
United Kingdom	Department of Energy and Climate Change Health and Safety Executive Offshore Division

Greenland	Bureau of Minerals and Petroleum (BMP)
Norway	Petroleum Safety Authority (PSA)

2.1.6 Coordination among regulatory bodies

Where more than one body has regulatory authority or operational responsibility over an aspect of offshore drilling, coordination is needed to ensure the effectiveness and efficiency of the regulatory regime. Coordination is particularly important in areas such as emergency response, where timely and effective action by several departments or agencies may be essential to minimize the risk of significant harm. Coordination to avoid conflicting requirements, duplication of effort and uncertainty regarding authority and accountability is also important from the perspective of regulated entities. Various mechanisms have been used to coordinate the mandates, regulatory authority and operational activities of departments and agencies with responsibilities for offshore drilling.

Canada’s NEB has informal cooperation and sometimes formal agreements (such as the Nunavut/NWT Spill Working Agreement) with other departments and agencies that regulate aspects of Arctic offshore drilling. In other countries where regulatory functions are divided among different authorities, memoranda of agreement have been used to facilitate coordination. For example, the U.S. Environmental Protection Agency and the U.S. Coast Guard have responsibilities with respect to certain objective-specific statutes relating to environment and safety regulations that overlap with BOEMRE’s responsibilities to protect the human and marine environments. To resolve this overlap and to avoid regulatory duplication, the three agencies have entered agreements defining discrete jurisdictional responsibility. In the U.K., a memorandum of understanding establishes frameworks for cooperation among the three organizations with responsibilities over aspects of health and safety enforcement and accident investigation that apply to offshore drilling.

2.1.7 Use of guidelines and best practices

This report focuses primarily on the statutes and regulations governing offshore drilling. It is important to note, however, that this legislation may refer to and in some cases incorporate by reference a variety of other documents that can include operational guidelines prepared by government and industry and best practice standards from industry, independent organizations or other jurisdictions. Some jurisdictions refer to guidelines or best practices directly in the regulations, making them binding and mandatory. Other jurisdictions use guidelines and best practices to help interpret the legislation or regulations or to provide a minimum or default requirement or reference point, although other approaches may be used as long as they meet the objective of the regulations.

This report is focused on legally enforceable regulations but in order to compare across jurisdictions it was important to mention guidelines or standards where they are referenced specifically by the regulations or intended to be used in the interpretation of the regulations.

- Canada's regulations for Arctic offshore drilling rarely reference standards or regulations, although some guidance documents for operators have been produced by the NEB. On March 31st, 2011, the NEB produced Environmental Protection Plan Guidelines¹² and Safety Plan Guidelines.¹³ However due to the time restrictions of this research,¹⁴ this material was not included in this research.
- In the U.S., BOEMRE frequently "incorporates" industry standards in its regulations, and maintains a list of all of these incorporated standards in its regulations, where it notes that the standards become mandatory, even where the standard itself uses permissive language, like "should."
- The U.K. has comprehensive regulations, but for most regulations there are guideline notes that explain the regulations in clear, plain language, giving context and examples to rely on; however, it is only the actual regulations that are enforceable.
- Greenland has no details in its legislation and instead guidelines are considered minimum requirements and are mandatory unless a deviation is approved.¹⁵
- Norway maintains guidelines for every provision of its core offshore oil and gas regulations and these unenforceable guidelines frequently reference industry-developed NORSOK standards.

¹² National Energy Board, *Environmental Protection Plan Guidelines* (2011) <http://www.neb-one.gc.ca/clf-nsi/rpblctn/ctsndrgltn/rgltnsndgdlnsprsnttthrcr/drlngprdctnrgltn/nvrnmntplngdln-eng.html>.

¹³ National Energy Board, *Safety Plan Guidelines* (2011), <http://www.neb-one.gc.ca/clf-nsi/rpblctn/ctsndrgltn/rgltnsndgdlnsprsnttthrcr/drlngprdctnrgltn/sftplngdln-eng.html>.

¹⁴ Only material that was in existence prior to March 15th, 2011 was included in this report.

¹⁵ Pers. Comm., Maja Sofie Burgaard, Special Advisor, Licence Department; Petroleum Section, Bureau of Minerals and Petroleum, Greenland Self-Government, May 5, 2011.

2.2 Canadian Arctic Offshore

Overview and Applicable Legislation

The main legislation for the offshore oil and gas in Canadian Arctic offshore is the *Canada Oil and Gas Operations Act*¹⁶ (COGOA). This Act regulates exploration for resources and operations of offshore activities. COGOA describes the responsibility of the operator to ensure worker safety and protection of the environment and outlines requirements to obtain a well approval.

A number of regulations under COGOA set out the requirements for activities during oil and gas exploration and production.

- The *Canada Oil and Gas Geophysical Operations Regulations* outline practices for seismic exploration and health and safety requirements for geophysical operations.¹⁷
- The *Canada Oil and Gas Drilling and Production Regulations* outline the requirements for drilling and production activities.¹⁸
- The *Canada Oil and Gas Installations Regulations* outline requirements for design of installation safety features.¹⁹
- The *Canada Oil and Gas Diving Regulations* outline safety requirements for diving activities conducted with respect to oil and gas activities.²⁰
- The *Canada Oil and Gas Certificate of Fitness Regulations* outline the requirements for obtaining a Certificates of Fitness for an offshore installation.²¹
- The *Oil and Gas Spills and Debris Liability Regulations* outline liability for spills or debris from oil and gas activities.²²

Health and safety requirements under the *Oil and Gas Occupational Safety and Health Regulations*, enabled by the *Canada Labour Code*, must be met for a well to be authorized. There are requirements for oil spill planning and preparedness under the *Canadian Environmental Protection Act*, the *Canadian Environmental Assessment Act*, the *Emergencies*

¹⁶ Government of Canada, *Canada Oil and Gas Operations Act c. O-7*, 1985, <http://laws-lois.justice.gc.ca/eng/acts/O-7/FullText.html?term=response>.

¹⁷ Government of Canada, *Canada Oil and Gas Geophysical Operations Regulations* SOR/96-117, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-117/index.html>.

¹⁸ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations* SOR/2009-315, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

¹⁹ Government of Canada, *Canada Oil and Gas Installations Regulations* SOR/96-118, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-118/index.html>.

²⁰ Government of Canada, *Canada Oil and Gas Diving Regulations* SOR/88-600 <http://laws-lois.justice.gc.ca/eng/regulations/SOR-88-600/index.html>.

²¹ Government of Canada, *Canada Oil and Gas Certificate of Fitness Regulations* SOR/96-114, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-114/FullText.html>.

²² Government of Canada, *Oil and Gas Spills and Debris Liability Regulations* SOR/87-331, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-87-331/index.html>.

*Act*²³ and the *Emergency Preparedness Act*.²⁴ For operations in the Beaufort Sea, there are stipulations for environmental assessment and financial liability under the *Inuvialuit Final Agreement*.

Regulatory Regime

The National Energy Board (NEB) is responsible for regulating northern and offshore oil and gas exploration and development under COGOA. The NEB assesses applications, issues authorization for well, and is the primary response and coordination body in the event of an oil spill.

Indian and Northern Affairs Canada (INAC) is responsible for issuing land tenure and licences, approving or waiving benefits plans, and collecting royalties in the Canadian Arctic. Natural Resources Canada is responsible for any areas outside of the territories and under federal jurisdiction that are not covered under the offshore accords. The administrative boundary separating the jurisdiction between INAC and NRCan extends from the main land near Southampton Island and along the southern part of Baffin Island out to the northern Labrador Sea. INAC manages rights and royalties north of this boundary, while NRCan does so south of this boundary.

Assessment from regional environmental review bodies is required for any project that may significant negative impact on present or future wildlife harvesting under the Inuvialuit Final Agreement.²⁵ These bodies include the Environmental Impact Screening Committee and the Environmental Impact Review Board in the Inuvialuit region, or the Nunavut Impact Review Board for activities in Nunavut waters. The Review Boards recommend terms and conditions for mitigating any negative impact on wildlife harvesting to the National Energy Board.²⁶ Environment Canada also reviews any projects that fall under the *Canadian Environmental Assessment Act*.²⁷

In Eastern Canada, the Canada–Nova Scotia Offshore Petroleum Board and the Canada–Newfoundland and Labrador Offshore Petroleum Board regulate drilling and production off the coasts of Nova Scotia and Newfoundland and Labrador, respectively.

The National Energy Board's approach is a blend of traditional prescriptive regulations with performance-based regulations. The *Canada Oil and Gas Drilling and Production Regulations*, updated in 2009, contain mostly performance-based regulations, while other regulations (in particular, the *Canada Oil and Gas Installations Regulations*, *Canada Oil and Gas Geophysical Operations Regulations* and the *Canada Oil and Gas Diving Regulations*) are mainly prescriptive.

²³ Government of Canada, *Emergencies Act*, 1985, c. 22 (4th Supp.) <http://laws-lois.justice.gc.ca/eng/acts/E-4.5/index.html>.

²⁴ Government of Canada, *Emergency Preparedness Act*, 1985, c. 6 (4th Supp.) <http://laws-lois.justice.gc.ca/eng/acts/E-4.6/>.

²⁵ Inuvialuit Final Agreement, <http://fishfp.sasktelwebhosting.com/publications/IFA.pdf>.

²⁶ Inuvialuit Final Agreement s.13(11), <http://fishfp.sasktelwebhosting.com/publications/IFA.pdf>.

²⁷ Government of Canada, *Canadian Environmental Assessment Act*, 1992, c. 37, <http://laws-lois.justice.gc.ca/eng/acts/C-15.2/>.

2.3 United States

Overview and Applicable Legislation

The primary legislation for the offshore oil and gas sector in the U.S. is the *Outer Continental Shelf Lands Act* (OCSLA),²⁸ which includes provisions specific to the management and oversight of resource development in the U.S. outer continental shelf beyond state jurisdiction.

The OCSLA authorizes the U.S. Department of the Interior (DOI) and the U.S. Coast Guard (USCG) to prepare and implement key regulations specific to economic activities offshore and seaward of the state boundaries. In particular, it establishes DOI's responsibility for the administration of offshore mineral exploration and development under federal jurisdiction, for the purposes, among others, of managing the offshore oil and gas resources and balancing resource development objectives with the protection of human, marine, and coastal environments.²⁹

There are also statutes of general application with issue-specific provisions that regulators similarly apply to other industrial and marine activities. These include statutes for a variety of specific objectives including environmental protection, safe navigation and oil pollution prevention.

Regulatory Regime

DOI delegates its regulatory authority to subsidiary regulatory bodies that are themselves offshore energy specialists. With ongoing changes following on the spring 2010 *Deepwater Horizon* blowout in the Gulf of Mexico, these subsidiary authorities are in the process of restructuring.

Until spring 2010, DOI delegated its responsibilities with respect to offshore energy to the Mineral Management Service (MMS). The MMS held responsibility for the three main administrative functions relating to offshore energy, engendering potential conflicting objectives:

- evaluating, planning, and leasing offshore oil and gas resources;
- implementing environmental and safety regulations; and
- collecting royalties and managing revenue from energy activities.³⁰

In May 2010, DOI embarked on a process of separating these three functions, to ensure independence in their respective administration, ultimately to be managed by new subsidiary agencies.³¹ As an initial step, DOI created the Bureau of Ocean Energy Management, Regulation

²⁸ Government of the United States, *Outer Continental Shelf Lands Act*, Public Law 212, Ch. 345, 67 Stat. 462, 43 U.S.C. 1331-1356a.

²⁹ Government of the United States, *Outer Continental Shelf Lands Act*, 43 U.S.C. 1332, 1334; Bureau of Ocean Energy Management, Regulation and Enforcement, "Outer Continental Shelf Lands Act," Sept. 29, 2010, <http://www.gomr.boemre.gov/homepg/regulate/regs/laws/ocslasht.html>.

³⁰ U.S. Bureau of Ocean Energy Management, Regulation and Enforcement, "Frequently Asked Questions," March 10, 2011, <http://www.boemre.gov/ooc/newweb/frequentlyaskedquestions/frequentlyaskedquestions.htm>.

³¹ The three functions, respectively, will be transferred to: 1) the Bureau of Ocean Energy Management; 2) the Bureau of Safety and Environmental Enforcement; and 3) the Office of Natural Resource Revenue. Secretary of the

and Enforcement (BOEMRE) and transferred all of MMS's responsibilities to BOEMRE, a temporary placeholder for restructuring and ultimately separating responsibilities.

The Environmental Protection Agency (EPA) and USCG also have responsibilities with respect to certain objective-specific statutes relating to environment and safety regulations. However, the purviews of these statutes at the regulatory level overlap with BOEMRE's OCSLA responsibilities to protect the human and marine environments. To resolve this overlap and to avoid regulatory duplication, the three agencies have entered agreements defining discrete jurisdictional responsibility, though overlap sometimes still exists.³²

An important example is a 1994 memorandum of understanding (MOU) establishing "responsibilities associated with oil-spill prevention and control, response planning, and response equipment inspection for offshore facilities," regulatory concerns legislated in the OCSLA and the *Oil Pollution Act* of 1990 amendments to the *Clean Water Act*.³³ The MOU assigns responsibility for offshore facilities located seaward of the coastline to the MMS (now BOEMRE).³⁴

As such, BOEMRE takes the lead in applying both the sector-specific regulatory mandates of the OCSLA and many of the broader, objective-specific regulatory purviews of other statutes that are applicable to the offshore energy safety and environmental performance issues addressed in this report.³⁵ On top of this core, the USCG has certain regulations relating to maritime safety, emergency preparedness and accident response, as well regulations specific to mobile offshore drilling units (MODUs).³⁶ Finally, the EPA has certain relevant programs for governmental emergency planning and cooperative responses relating to oil spills and disasters.³⁷

Interior, Order No. 3299, May 19, 2010,

<http://www.doi.gov/deepwaterhorizon/loader.cfm?csModule=security/getfile&PageID=32475>; U.S. Bureau of Ocean Energy Management, Regulation and Enforcement, "Frequently Asked Questions."

³² U.S. Bureau of Ocean Energy Management, Regulation and Enforcement, "Regulatory Compliance: MMS Agreements," Sept. 17, 2010, <http://www.boemre.gov/regcompliance/MOU/MOUindex.htm>.

³³ U.S. Minerals Management Service, *Memorandum of Understanding Establishing Jurisdictional Responsibilities for Offshore Facilities*, 1994 Fed. Reg. 9494, February 28, 1994, <http://www.boemre.gov/PDFs/FR9494.pdf>.

³⁴ Under the MOU, the EPA has jurisdiction over non-transportation-related offshore facilities located *landward* of the coastline in bodies such as lakes, rivers, streams, and coastal wetlands (which legislation includes as "offshore" in the United States). The USCG has jurisdiction over *transportation-related* offshore facilities. *Ibid*.

³⁵ These include regulations for safety, environmental protection, and accident prevention in offshore oil and gas exploration, development, and production operations and are mostly found in "Oil and Gas and Sulphur Operations in the Outer Continental Shelf", U.S. Code of Federal Regulations Title 30, Pt. 250. Its regulations relating to oil-spill response requirements are found in "Oil-spill Response Requirements for Facilities Located Seaward of the Coast Line", U.S. Code of Federal Regulations Title 30, Pt. 254.

³⁶ "Offshore Oil Pollution Compensation Fund", U.S. Code of Federal Regulations Title 33, Pt. 135; "Outer Continental Shelf Activities", U.S. Code of Federal Regulations Title 33, Subchapter N; "Mobile Offshore Drilling Units", U.S. Code of Federal Regulations Title 46, Subchapter I-A. An MOA between the USCG and MMS delineates regulatory jurisdiction with respect to these subject matters: *Memorandum of Agreement between the Minerals Management Service—U.S. Department of the Interior and the U.S. Coast Guard—U.S. Department of Homeland Security: Floating Offshore Facilities*, MMS/USCG MOA: OCS-04, Feb. 28, 2008, <http://www.boemre.gov/regcompliance/MOU/PDFs/MOA-USCG04FloatingFacilities-Final.pdf>.

³⁷ "National Oil and Hazardous Substances Pollution Contingency Plan", U.S. Code of Federal Regulations Title 40, Part 300. Most of the EPA's offshore regulations are either not applicable to offshore facilities seaward of the coastline or relate to issues not addressed in this report, such as air emissions.

Regulatory Approach

The U.S. regulatory regime is primarily prescriptive, mandating precise requirements for offshore facility operators to meet.³⁸ Where a regulatory provision does not direct precise technical requirements directly, they regularly “incorporate” industry standards, usually the American Petroleum Institute’s Recommended Practices (API RPs), which are only available for purchase. When a regulation incorporates one of these standards, the standard becomes enforceable and its “should” suggestions become “must” requirements under the regulation.³⁹

Further prescriptive regulations are likely as DOI has committed to implementing the recommendations in the Safety Measures Report requested by the U.S. president in light of the *Deepwater Horizon* blowout.⁴⁰ Changes recommended relate to redundancy in blowout preventers, well integrity, well control, and the culture of safety through operational and personnel management. Indeed, among the first steps, on October 14, 2010, BOEMRE promulgated an interim rule for prescriptive safety measures for well control.⁴¹

Around the same time, BOEMRE took the final steps of a process, initiated by the MMS before the *Deepwater Horizon* blowout, to implement a new Safety and Environmental Management System (SEMS).⁴² The new SEMS requirement, while leaving primary responsibility for SEMS implementation and oversight to the operator, is itself relatively prescriptive, mandating in detail the elements of an operator’s SEMS program, rather than simply setting the objectives of such programs and leaving details to operators.

³⁸ Det Norske Veritas, *OLF/NOFO – Summary of Differences between Offshore Drilling Regulations in Norway and U.S. Gulf of Mexico*, Rev. 02, Aug. 26, 2010, 22-23.

³⁹ “Documents Incorporated by Reference”, U.S. Code of Federal Regulations Title 30, Pt. 250.198(a)(3).

⁴⁰ U.S. Department of the Interior, *Increased Safety Measures for Energy Development on the Outer Continental Shelf*, (2010), <http://www.doi.gov/deepwaterhorizon/loader.cfm?csModule=security/getfile&PageID=33598>.

⁴¹ U.S. Bureau of Ocean Energy Management, Regulation and Enforcement, *Increased Safety Measures for Energy Development on the Outer Continental Shelf*, 2010 Fed. Reg. 63610, October 14, 2010, <http://edocket.access.gpo.gov/2010/pdf/2010-25256.pdf>.

⁴² *Ibid.*

2.4 United Kingdom

Overview and Applicable Legislation

In the United Kingdom, the central body of legislation governing the offshore oil and gas sector is the *Petroleum Act 1998*.⁴³ This parliamentary act regulates development in the U.K. continental shelf, located in the North Sea off the eastern coast of the U.K., which contains the bulk of the country's oil reserves.

The *Petroleum Act* authorizes the Department of Energy and Climate Change (DECC) and the Health and Safety Executive (U.K. HSE) to prepare and implement key regulations specific to oil and gas development activities. In particular, the DECC is responsible for the licensing, exploration and development of oil and gas, whereas the U.K. HSE Offshore Division is responsible for regulating hazardous risks to health, safety and the environment arising from work activity in the offshore oil and gas industry. The Marine and Coastguard Agency is the U.K. national authority for oil spill response and planning, although they have granted to DECC, on an agency basis, their oil spill planning regulatory function for offshore oil and gas installations.

The Department of Environment, Food and Rural Affairs (DEFRA) for England and Wales and its Scottish equivalent, the Scottish Government Environment Directorate, have responsibility for protection of the environment and fisheries. Scientific fisheries institutions also contribute to this area; this includes the Centre for Environment, Fisheries and Aquaculture Science (CEFAS), which is a research executive agency of DEFRA.

The main operational functions of DEFRA/CEFAS directly affecting environmental controls of offshore activity include:

- offshore drilling, production and utility chemicals including: testing and classification of chemicals, consultation over large-scale use, advice to DECC on the Offshore Chemical Notification Scheme;
- licensing, testing and permission to use dispersants;
- consulting and advising the DECC on development of oil spill plans in order to discharge their responsibility for marine environmental protection;
- consulting and advising the DECC on submitted Environmental Statements; and
- licensing of dumping at sea including pipelines and decommissioning.

Key legislation for which DEFRA and Scottish Government have enabled powers are the *Environmental Protection Act 1990* and the *Food and Environment Protection Act 1985*.

Numerous statutes of general application have regulatory provisions that are more issue-specific but that regulators similarly apply to other industrial and marine activities. These include statutes for such objectives as environmental protection, safety at work and pollution prevention.

⁴³ Government of United Kingdom, *Petroleum Act 1998*, c.17, <http://www.legislation.gov.uk/ukpga/1998/17/contents>.

It should be noted that as part of the European Community, the U.K. must abide by European legislation. Requirements set by the European Commission tend to be more prescriptive, whereas U.K. has an expressed preference to maintain performance-based requirements.⁴⁴ Nevertheless, oil and gas regulation in the U.K. meet the minimum requirements set by the relevant European Directives; these include requirements for the best available techniques and best environmental practice and requirements for improving the safety and health of workers.⁴⁵

The U.K. is also party to the Convention for the Protection of the Marine Environment of the North East Atlantic, 1992 (OSPAR Convention).⁴⁶ This enshrines several principles in the approach to the oil and gas regime:

- the precautionary principle
- the polluter pays principle
- best available techniques and best environmental practice

OSPAR also acts as a reference point in the North Sea for example, where the U.K. and Norway have adjacent jurisdiction. At the time of authorship of this document, the OSPAR Commission is awaiting the outcomes of national reviews of regulations following the Gulf of Mexico spill before proposing any new measures.

Regulatory Regime

The U.K.'s health and safety regime was fundamentally changed following the *Piper Alpha* disaster in 1988, in which 167 people lost their lives. One of the most significant changes was the removal of responsibility for enforcing safety standards from the licensing and development regulator. This change came about in response to recommendations contained in the public inquiry into the *Piper Alpha* disaster (the first Lord Cullen Report). The Cullen Report based this recommendation on the conclusion that having one agency responsible for overseeing both production and safety could create a conflict of interest.⁴⁷

The U.K. regulatory system consists of a range of instruments. Parliamentary Acts set the framework and establish the powers for ministers to regulate specific activities. Regulations are derived from these acts to provide more details as to the requirements. The U.K. HSE also provides guidance where it believes regulations are not self-explanatory. This has quasi-legal status as follows:

“This guidance is issued by the Health and Safety Executive. Following the guidance is not compulsory and you are free to take other action. But if you do follow the guidance you will

⁴⁴ Oil & Gas U.K., “The Statutory Regime,” Environmental Legislation website, <http://www.ukooaenvironmentallegislation.co.uk/contents/pages/statutory.htm>.

⁴⁵ Ibid.

⁴⁶ OSPAR Commission, *About OSPAR*, http://www.ospar.org/content/content.asp?menu=00320109000000_000000_000000.

⁴⁷ The Honourable Lord Cullen, *The Public Inquiry into the Piper Alpha Disaster* (HM Stationery Office, 1990).

*normally be doing enough to comply with the law. Health and safety inspectors seek to secure compliance with the law and may refer to this guidance as illustrating good practice*⁴⁸

The U.K. HSE can also issue further notices, information sheets and circulars which may provide new interpretation of regulations, which operators are required to implement.⁴⁹

Regulatory Approach

The U.K. HSE currently uses a “goal-setting,” or performance-based, approach to safety and environmental regulation. Companies are required to continually demonstrate to the U.K. HSE that they are taking measures to minimize the risk of health and environmental hazards to As Low As Reasonably Practicable (ALARP).⁵⁰ It is assumed that by allowing flexibility, industry can take a more responsive approach to choosing the best methods or equipment available at the time, i.e. incorporating new technologies and techniques more rapidly.⁵¹ This approach was another key recommendation made in the Cullen Report to prevent future disasters like the *Piper Alpha*.

The ALARP approach also requires a judgement by the regulator as to what is “reasonable,” which involves consideration of costs as well. This means that further measures may be available, but the risk reduction achieved by applying them would entail an unreasonable cost. In this regulatory system, regulators must ensure that the operators have the same appetite for risk as the government, so that people and the environment are not exposed to unacceptable levels of risk. The context and level of hazard must also be taken into account, meaning that the measures required may vary across different locations.

The Government explains that it expects operators to apply “good practice” and provides guidance and accepted codes of practice which describe this. Following the advice in an accepted code of practice, on the specific matters on which it gives advice, is enough to comply with the law, and can be used as a defence in a legal case.⁵²

Within the U.K. regulatory regime the onus is on the duty holder to demonstrate that whatever provision (procedure, standard, system or hardware) is in place meets the goal defined within the regulations. Hence, if an international standard is used in the design of a safety critical element, the Duty Holder must be able to demonstrate that the resulting design meets the required performance standard.

⁴⁸ Government of the U.K., *Status of technical guidance and information on design, construction and operation of offshore installations*, Operations notice: 27, Issue date: Sept 2003, revised Oct 2010, http://www.hse.gov.uk/offshore/notices/on_27.htm

⁴⁹ U.K. Health and Safety Executive, “Offshore information sheets,” http://www.hse.gov.uk/offshore/infosheets/is_index.htm.

⁵⁰ Oil & Gas U.K., *Britain’s Offshore Oil and Gas*, 2nd edition (2002) <http://www.oilandgasuk.co.uk/publications/viewpub.cfm?frmPubID=4>.

⁵¹ Ibid.

⁵² Government of the U.K., “Assessing compliance with the law in individual cases and the use of good practice.” Revised May 2003, <http://www.hse.gov.uk/risk/theory/alarp2.htm>.

2.5 Greenland

Overview and Applicable Legislation

Greenland (*Naalakkersuisut*), still officially part of the Kingdom of Denmark, received home rule in 1979, after which it was self-governing in many domestic areas. After the promulgation of the *Act of Greenland Self-Government* of June 21, 2009, Greenland was granted independence from Denmark (though with Denmark still controlling foreign affairs and national defence) and obtained the right to manage the development of minerals, petroleum and the working environment.⁵³ Mineral and petroleum development was one of the first priorities for the new Greenland Self Government, as revenues generated from the extractive industry would help reduce Greenland's dependence on Danish block grants.⁵⁴ These block grants have been used during the home rule period to support the local economy and government.

On January 1, 2010, the "*Inatsisartut Act no. 7 of 7th of December 2009 on Mineral Resources and Activities Affecting These [Mineral Resources Act]* was promulgated, replacing the Danish *Act on Mineral Resources in Greenland*, cf. Consolidation Act no. 368 of 18th of June 1998."^{55,56} The *Mineral Resources Act* has given Greenland full control over the development of their mineral and petroleum resources. The Act requires offshore drilling activities to be performed using the best international practices and that any drilling activity needs the permission of the Greenland Self Government.⁵⁷ Based on the principle of a unified, integrated regulatory system for offshore drilling, the Act considers the environment, technical issues, health and safety, socio-economic issues and resources.⁵⁸ Explanatory notes to the *Mineral Resources Act* provide further detail on each section of the Act.⁵⁹

Regulatory Regime

The Greenland Bureau of Minerals and Petroleum, under the Ministry of Industry and Labour, administers the *Mineral Resources Act* and is the sole government agency responsible for the development (tenure disposition and royalty collection), environmental regulation and health and

⁵³ Greenland Bureau of Minerals and Petroleum, *Exploration and exploitation of hydrocarbons in Greenland, Strategy for License Policy* (December 2009), http://uk.nanoq.gl/Emner/Government/Departments/ministry_of_industry_and_mineral_resources/~media/1F66073BE1E54C66A499D38C8846F101.ashx

⁵⁴ *Ibid.*, 7.

⁵⁵ *Ibid.*

⁵⁶ Greenland Self Government. *Greenland Parliament Act of 7 December 2009 on Mineral Resources and Mineral Resource Activities (The Mineral Resources Act)*, http://www.bmp.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf

⁵⁷ Greenland Bureau of Minerals and Petroleum, *Exploration and exploitation of hydrocarbons in Greenland*, 7.

⁵⁸ *Ibid.*, 7-8.

⁵⁹ Greenland Self Government, *General Explanatory Notes on the Act on Mineral Resources 2009*, http://www.bmp.gl/images/stories/faelles/explanatory_notes_to_the_mineral_resources_act.pdf

safety regulation of offshore drilling.^{60,61} As Greenland's first offshore drilling legislation was introduced in 2010 and Greenland has no producing wells, their regulatory regime is still emerging. Subordinate legislation, rules and regulations under the *Mineral Resources Act* are under development.

Regulatory Approach

Oil and gas activities in Greenland are based on a regulatory approach in the Scandinavian tradition, where the primary regulatory source is the law, followed by executive orders, guidelines and standards.⁶² Adherence to this regulatory system is considered mandatory.⁶³ The regulatory approach created in the *Mineral Resources Act* a) creates a single, unified regulatory system where environmental, technical, health and safety, socio-economic and other resource issues are considered by one regulator, the Bureau of Minerals and Petroleum and b) places the burden of proof on offshore drilling companies to demonstrate that they adhere to acknowledged best international practices. This performance-based approach is intended to be easy to use and efficient and provide regulators with a mechanism to ensure industry adopts current best practices without having to update legislation or regulations.⁶⁴ Greenland, through the *Mineral Resources Act*, intends to promote “what is attainable through the use of the best available techniques, including less polluting facilities, machinery, equipment, processes, technologies, raw materials, substances and materials and the best possible measures for combating pollution. In this assessment, particular importance must be attached to preventive measures through the use of cleaner technology.”⁶⁵

In Greenland, any offshore drilling activity must have a licence, which stipulates the terms, obligations and rights of the licensee, as described in Section 16 and Sections 22-28 of the *Mineral Resources Act*.⁶⁶ Furthermore, all offshore drilling activity must also have an approval letter from the Bureau of Mineral and Petroleum, as described in Sections 15 and 86 of the *Mineral Resources Act*.⁶⁷ This letter provides specific details on how the law, executive orders, guidelines and standards are to be adhered to and may stipulate additional requirements, if necessary.⁶⁸

⁶⁰ Greenland Bureau of Minerals and Petroleum, “Contact,” <http://www.bmp.gl/about-bmp/contact>.

⁶¹ Government of Greenland, “Ministry of Industry and Labour,” http://uk.nanoq.gl/emner/government/departments/ministry_of_industry_and_mineral_resources.aspx.

⁶² Pers. Comm., Maja Sofie Burggaard, Special Advisor, Licence Department; Petroleum Section, Bureau of Minerals and Petroleum, Greenland Self-Government, May 5, 2011.

⁶³ Ibid.

⁶⁴ Greenland Self Government. *General Explanatory Notes on the Act on Mineral Resources 2009*, 3.

⁶⁵ Greenland Self Government, *Mineral Resources Act*, Section 52.

⁶⁶ Greenland Self Government. *Greenland Parliament Act of 7 December 2009 on Mineral Resources and Mineral Resource Activities (The Mineral Resources Act)*, http://www.bmp.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf

⁶⁷ Greenland Self Government. *Greenland Parliament Act of 7 December 2009 on Mineral Resources and Mineral Resource Activities (The Mineral Resources Act)*, http://www.bmp.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf

⁶⁸ Pers. Comm., Maja Sofie Burggaard, Special Advisor, Licence Department; Petroleum Section, Bureau of Minerals and Petroleum, Greenland Self-Government, May 5, 2011.

In March 2010, Exploration Drilling Guidelines were developed to create a framework for Greenland's offshore drilling activities and also to ensure flexibility and clarity for both offshore drilling proponents and Greenland's offshore drilling regulator.⁶⁹ These guidelines provide detailed direction to the offshore drilling industry on how the regulator interprets the *Mineral Resources Act*, any subordinate legislation and other national and international legislation and regulation.⁷⁰ The Exploration Drilling Guidelines are considered a 'live' document and also align with other guidelines recognized by Greenland, such as the Arctic Council Arctic Offshore Oil and Gas Guidelines.^{71,72} The Arctic Council is an intergovernmental forum for Arctic governments (and Arctic indigenous people). Canada is a member of the Arctic Council, along with Denmark (including Greenland and the Faroe Islands), Finland, Iceland, Norway, Russian Federation, Sweden and the United States. Industry-developed NORSOK standards, which the Bureau of Minerals and Petroleum considers the best international practice in their field, forms the basis for the Exploration Drilling Guidelines.⁷³

The Exploration Drilling Guidelines and NORSOK standards are considered minimum requirements and are mandatory unless specific exemptions are approved.⁷⁴ Beyond the guidelines, Section 76 and 86 of the *Mineral Resources Act* also gives the Bureau of Minerals and Petroleum the authority to establish terms and conditions directly in a drilling approval.⁷⁵ While not available at the time of writing, a new edition of the drilling guidelines was released in May 2011.⁷⁶

⁶⁹ Greenland Bureau of Minerals and Petroleum, *Exploration and exploitation of hydrocarbons in Greenland*, 1.

⁷⁰ Pers. Comm., Maja Sofie Burggaard, Special Advisor, Licence Department; Petroleum Section, Bureau of Minerals and Petroleum, Greenland Self-Government, May 5, 2011.

⁷¹ Ibid.

⁷² Arctic Council, *Arctic Offshore Oil and Gas Guidelines* (2002).

http://www.bmp.gl/images/stories/petroleum/environmental_reports/ArcticGuidelines_Oil_and_Gas.pdf

⁷³ Pers. Comm., Maja Sofie Burggaard, Special Advisor, Licence Department; Petroleum Section, Bureau of Minerals and Petroleum, Greenland Self-Government, May 5, 2011.

⁷⁴ Ibid.

⁷⁵ Ibid.

⁷⁶ Bureau of Minerals and Petroleum, Exploration Drilling Guidelines, May 2011, http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf (accessed May 8, 2011).

2.6 Norway

Overview and Applicable Legislation

A wide array of legislation is applicable to the Norwegian oil and gas sector, including statutes relating to labour and working conditions; health and health care; pollution prevention; petroleum activities; and fire and explosion prevention. Most of these are broad statutes of general application, most commonly housing only provisions that are not specific to the offshore oil and gas sector, but include the sector in their application.

A highly coordinated regulatory regime in Norway incorporates the applicable mandates of this long and diverse string of legislation. A single authority, the Petroleum Safety Authority (PSA), administers the regime and coordinates other regulatory authorities. As such, the regulations that the PSA promulgates provide a focused location for research into the specific regulatory regime applicable to the offshore oil and gas sector.

Regulatory Regime

Subordinate to the Ministry of Labour, the PSA has “regulatory responsibility for safety, emergency preparedness and the working environment in the petroleum sector,” both on- and offshore.⁷⁷ The PSA’s regulatory purview over “safety” includes threats to “human life, health and welfare, the natural environment, and financial investment and operational regularity.”⁷⁸ Therefore, the PSA promulgates most of the relevant regulations covered in this report. The Norwegian government, moreover, designated the PSA as the key coordinator for the group of independent regulators with authority over health, safety and environmental regulations: the Climate and Pollution Agency (“Klif”), the Board of Health, the Coastal Directorate, and the Industrial Safety Organization.⁷⁹ The PSA does not have responsibility for leasing or revenue and royalty collection.

The PSA has five applicable sets of regulations:

- the *Framework Regulations*;⁸⁰
- the *Management Regulations*;⁸¹
- the *Facilities Regulations*;⁸²
- the *Activities Regulations*;⁸³

⁷⁷ Petroleum Safety Authority Norway, “Role and Area of Responsibility,” 2008, <http://www.ptil.no/role-and-area-of-responsibility/category165.html>.

⁷⁸ Petroleum Safety Authority Norway, “About Us,” <http://www.ptil.no/about-us/category89.html>.

⁷⁹ Petroleum Safety Authority Norway, “Role and Area of Responsibility.”

⁸⁰ Petroleum Safety Authority Norway, *Regulations Relating to Health, Safety, and the Environment in the Petroleum Activities and at Certain Onshore Facilities (The Framework Regulations)*, 2010, <http://www.ptil.no/framework-hse/category403.html>.

⁸¹ Ibid.

⁸² Petroleum Safety Authority Norway, *Regulations Relating to Design and Outfitting of Facilities, etc. in the Petroleum Activities (The Facilities Regulations)*, 2010, <http://www.ptil.no/facilities/category400.html>.

⁸³ Petroleum Safety Authority Norway, *Regulations Relating to Conducting Petroleum Activities (The Activities Regulations)*, 2010, <http://www.ptil.no/activities/category399.html>.

- the *Information Duty Regulations*.

Until recently, each was specific to the offshore petroleum industry. However on January 1, 2011, the PSA applied the two broader, management-oriented sets of offshore regulations, the *Framework Regulations* and the *Management Regulations*, to the onshore sector, to foster consistency across the industry. At the same time, the PSA made minor changes to each set. These *Framework Regulations* and *Management Regulations* concentrate on high-level regulatory and management themes like responsibility, risk reduction, management systems and analysis and measuring.

Also on January 1, 2011, the PSA enacted slightly changed *Facilities Regulations* and *Activities Regulations*. These more technically detailed and specific regulations continue to apply specifically to the offshore sector. The *Facilities Regulations* relate to design and outfitting facilities for workplace health and safety, pollution prevention, and emergency preparedness, while the *Management Regulations* focus on managing operations for these same purposes. The fifth regulation, the *Information Duty Regulations*, govern relevant notification and reporting requirements addressed in this report.

Regulatory Approach

As Norway employs a performance-based regulatory approach, its regulations contain very few mandatory technical requirements. Instead, they establish requirements to manage operations and build facilities to meet certain objectives, often performance requirements for identifying and reducing risk, along with requirements for management systems to ensure performance attainment.⁸⁴

The PSA publishes and regularly updates a non-legally-binding guideline for each provision of each of the sets of regulations.⁸⁵ In this way, the PSA recommends practices for fulfilling the regulation (“should”), then offers alternatives (“may”) for offshore installations to meet the requirements where they can show that the method is equally effective in attaining the same objective.⁸⁶ Regularly, these recommended practices and suggested alternatives refer to industry standards.

This reveals a primarily performance-based regulatory approach, where the regulator seeks to mandate a level of HSE performance, while leaving flexibility in the specific structural feature or operational practice for attainment. Indeed, the PSA acknowledges a concerted effort to move toward performance-based regulation from the prescriptive efforts of Norwegian regulators in the industry’s early years.⁸⁷ This also leaves primary responsibility for ensuring attainment of performance to the operator,⁸⁸ by placing the onus for proving compliance with performance-

⁸⁴ See, e.g., Petroleum Safety Authority Norway, *Framework Regulations*.

⁸⁵ Petroleum Safety Authority Norway, “Guidelines,” <http://www.ptil.no/guidelines/category218.html>

⁸⁶ Ibid.; Det Norske Veritas, *OLF/NOFO – Summary of Differences between Offshore Drilling Regulations in Norway and U.S. Gulf of Mexico*, Rev. 02, Aug. 26, 2010, 14-15.

⁸⁷ Petroleum Safety Authority Norway, “From Prescription to Performance in Petroleum Supervision,” media release, March 12, 2010, <http://www.ptil.no/news/from-prescription-to-performance-in-petroleum-supervision-%20article6696-79.html>.

⁸⁸ Det Norske Veritas, *OLF/NOFO*, 16-18; Petroleum Safety Authority Norway, “Role and Area of Responsibility.”

based regulations on the operator rather than leaving inspection for non-compliance to the regulator.

3. Management Systems Requirements

This chapter examines the management systems requirements for offshore drilling operations in the Canadian Arctic, the U.S., the U.K., Greenland, and Norway. To compare the regulatory regime of these five jurisdictions, this chapter includes an overview of the regulations governing management systems, identification of responsibilities to create and maintain the management system, and the requirements placed on management systems on issues of occupational health and safety, personnel competency and training, emergency preparedness, reporting and notification of emergencies, and performance monitoring and compliance. A comparison of these requirements among all jurisdictions is made in Table 4 (below).

Overview of management systems

A management system is a framework of plans, processes and procedures used to ensure that an offshore installation will fulfill the regulatory requirements concerning health, safety and the environment, and meet safety and environmental objectives such as avoiding and preparing for accidents and emergencies. The purpose of a management system is to identify hazards and mitigate or eliminate risk.

Management systems are required for approval and licencing for offshore drilling in all jurisdictions reviewed in this report. It is also required that the management system be maintained and updated during drilling operations. An installation's management system is created and maintained by those responsible for the installation.⁸⁹

Management systems are either 'prescriptive' or 'performance-based.' So-called prescriptive regulations outline specific, detailed requirements that must be met by the management system for licensing to be granted. Conversely, performance-based regulations outline certain goals with respect to health, safety and the environment that the management systems must achieve. Under a performance-based regulatory approach, to receive permit to drill, the applicant must *prove* to the regulator that these goals will be met and surpassed through the plans and procedures laid out in the installation's management system.

While there is a clear delineation between the two approaches to regulating management systems, many jurisdictions blend elements of both. By way of overview, it may be said that the management system regulations in the Canadian Arctic and the U.S. (called Safety Environmental Management Systems or SEMS) are generally more prescriptive than the regulations in the U.K., which can be described as relatively more performance-based. U.K. regulations require that those responsible for the installation submit a 'safety case' that proves to

⁸⁹ Those responsible for an offshore installation differs between jurisdictions. In the Canadian Arctic offshore, the responsible party is referred to as the 'operator'

the regulator that the goal-based regulatory requirements will be met. In the Canadian Arctic and the U.S., on the other hand, management systems are designed to follow a list of required processes which meet certain safety and environmental goals and objectives.

Generally, the regulations in Norway are similar to those of the U.K. in that they are performance-based. Those responsible for the installation must design their management system to meet and exceed the regulatory requirements concerning risk management.

Greenland's requirements for management systems are less identifiable as prescriptive or performance-based, since they do not outline their own regulations but replicate "international best practices."

Responsibilities

Management systems are required in every jurisdiction treated in this report.⁹⁰ The responsibility to create a management system during the approval phase rests either with the party that is applying for authorization to drill offshore, or with the installation operator that is appointed by the applicant, depending on the jurisdiction. After approval is granted, the responsibility to maintain and improve the management system either remains with the applicant, now referred to as a licence holder or transfers to the operator of the installation, who is appointed by the licence holder, depending on the jurisdiction. It is important to note that in Canada the 'operator' is the licence holder,⁹¹ whereas in all jurisdictions the 'operator' may or may not be the licence holder, depending on whether the licence holder appoints a separate party to operate the installation or operates it themselves.

As detailed below, all jurisdictions reviewed require that Management systems must be submitted to the regulator prior to approval to drill. After authorization is granted, all regulators reserve the right to inspect an installation's management system. Regulations in the U.K. and Norway specifically state that the regulators are not responsible for inspecting management systems after approval, because this would imply that if an accident did occur, the regulator might be accused of not having adequately inspected the management system and therefore might be considered, in part, at fault for the accident. These specifications are consistent with their performance-based regulations.

Occupational health and safety

Occupational health and safety refers to the requirements concerning worker health and safety that must be met. These requirements are generally the same across all jurisdictions; namely, that installations must maintain safe working conditions on offshore installations for all workers. While the goal is the same, different jurisdictions require its fulfillment differently. Some prescribe necessities to be met within the same regulatory document that treats the management

⁹⁰ While a management system is not legally required in Greenland, authorization to drill is not given without one.

⁹¹ In Canada the term 'operator' refers to "a person that holds an operating licence and an authorization" to drill (Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 1, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>). This terminology is unique to Canada. In all other jurisdictions the term 'operator' does not refer to the person or group that holds the licence, but has responsibility delegated to it by the licence holder.

system, whereas others refer to adjoining regulations and regulations of general application that prescribe the requirements for occupational health and safety.

Personnel competence and training

Similar to those of occupational health and safety, the requirements that must be met by management systems concerning personnel competency and training are nearly the same across all jurisdictions, but the regulations by which jurisdictions strive to meet that goal vary. Specifically, all jurisdictions require, to some extent, that personnel be competent and trained, and there must be provisions in the management system for these goals to be met.

Emergency preparedness

In all jurisdictions, management systems are required to have plans and procedures in place in the event of an emergency. Emergencies include events that jeopardize human or environmental safety.

Many jurisdictions have further requirements for oil spill preparedness beyond those required to be contained in an installation's management system. This section compares strictly the requirements that are necessary to be contained in an installation's management system. A comparison of the full oil spill requirements in these jurisdictions can be found in Chapter 8.

Reporting and notification of accidents or emergencies

Management systems in all jurisdictions require that the appropriate government authorities be notified in the event of an emergency concerning an offshore installation. Most jurisdictions require that any accident, even a 'near-miss', be reported so that risks may be monitored and performance tracked.

Performance monitoring and compliance

After approval to drill has been granted, all jurisdictions, in some way, require that performance and compliance be monitored. Strategies to accomplish this include annual reviews, third-party audits, or the possibility for an announced inspection by the regulator. An installation's requirements for audits and verification are included in this section insofar as they are included in requirements for an installation's management system. For a more in-depth discussion and comparison of independent verification and auditing requirements beyond those contained in the management system requirements, see Chapter 7.

Table 4: Comparison of management systems requirements by jurisdiction to Canadian Arctic Offshore

Regulatory Topic	Canadian Arctic Offshore	United States	United Kingdom	Greenland	Norway
1. Overview of management systems	Offshore operations in the Arctic are regulated by the National Energy Board (NEB).	Regulated by the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE).	Regulated by the Health and Safety Executive (U.K. HSE).	Regulated by Bureau of Minerals and Petroleum (BMP).	Regulated by Petroleum Safety Authority (PSA).
	Required in order to receive approval and mandatory that it remains up-to-date during operations.	Required in order to receive approval and mandatory that it remains updated during operations.	Required in order to receive approval and mandatory that it remains updated during operations.	The permitting authority (BMP) requires a management system be in place prior to approval and during drilling, since it is recognized as an “international best practice,” and a permit will not be granted without one.	Required in order to receive approval and mandatory that it remains updated during operations.
	The required safety and environmental processes and goals of the management systems are prescribed in detail by the regulator.	Management systems are prescribed by the regulator and referred to as Safety and Environmental Management Systems (SEMS).	Management systems are not prescribed by the regulator; rather they are developed from the creation and submission of the Safety Case to the regulator.	Referred to as a Safety Management System. They are prescribed by mandatory guidelines that follow “international best practices.”	Management systems are not prescribed by the regulator but are created by the developer as part of their risk management strategy.
	<i>Ocean Ranger</i> disaster (1982) has had an influence on management system regulations in	Management system regulations are recently developed as a result of <i>Deepwater Horizon</i> disaster (2010);	Current management system regulations and the requirement of a safety case developed after <i>Piper Alpha</i>	No major event in sovereign waters has influenced regulation.	More emphasis placed on risk management after the <i>Alexander Kielland</i> disaster

Management Systems Requirements

	Canada.	previously management systems were not a requirement.	disaster (1988).		(1980).
2. Responsibilities	The applicant is responsible for designing the management system prior to authorization.	The applicant (the lessee or the owner or holder of operating rights in U.S.) or a designated operator or agent of the applicant must develop a SEMS before a lease is granted.	The operator has the duty to design the safety case prior to authorization. However, it is the applicant ("licensee" in U.K.) that is responsible for the actions of the operator.	The March 2010 Exploration Drilling Guidelines state that the operator must have a "recognized" management system in place.	The operator (the 'responsible party' in Norway) is responsible for submitting the management system for authorization.
	Operator has the responsibility to ensure that the management system is followed and reviewed after authorization.	The applicant (the lessee, the owner or holder of operating rights) or a designated operator or agent of the applicant is responsible for implementing and maintaining the SEMS during the life of the lease.	After approval, the operator has the duty to abide by and update the safety case.	The guidelines explain that it is a requirement to maintain a relevant management system, because doing so is a recognized international best practice. However the guidelines indicate that the BMP must verify that this is done.	It is the joint responsibility of the licensee and the operator to ensure that all work complies with the management system after authorization is granted.
3. Occupational health and safety	Extensive, specific requirements in all aspects of offshore activities relating to occupational health and safety.	More general requirements, leaving specific requirements to supporting legislation.	No specific requirements set for working conditions in the management system (safety case), simply that operations must be compliant to other relevant statutory provisions.	No specific requirements set for working conditions in the management system, simply that operations must be compliant to supporting "programs," although such requirements could be included in a	The management system must ensure compliance with HSE requirements specified in other legislation.

Management Systems Requirements

				licence or an approval letter.	
	Must “identify hazards [to] manage the associated risks,” and take “all reasonable precautions.”	Must conduct “hazard analysis.” Must conduct “job safety analysis.”	Specified that management system must identify and evaluate the risks of “major hazards” of operations.	Health and safety risks must be identified, assessed and reduced “as much as is practically possible.”	Risk must be reduced to the lowest extent possible.
4. Personnel competence and training	It is the responsibility of the operator to ensure personnel are trained and competent to perform duties.	It is the responsibility of the lessee to ensure that the operator personnel are trained and competent to perform duties.	It is the duty of licensee to ensure that the operator personnel are trained and competent to perform duties.	Generally required that personnel must be trained and competent to perform duties.	Necessary personnel must be trained and competent to perform duties.
	There must be a sufficient number of individuals to complete activities of high risk.	Minimum number of workers not specified.	There must be a sufficient number of individuals to complete activities.	Minimum number of workers not specified, although such requirements could be included in a licence or an approval letter.	There must be a sufficient number of individuals to complete activities of high risk.
	NEB may consider training and competency of personnel before granting authorization.	BOEMRE reserves the right to evaluate and verify that operation personnel are competent.	U.K. HSE reserves the right to evaluate and verify that operation personnel are competent and that they adhere to the safety case.	BMP must verify competency and training.	The operator must verify competency and training.

Management Systems Requirements

5. Emergency preparedness	<p>Must identify any hazards and manage the associated risks.</p> <p>Prescriptive requirements for contingency plans and emergency response procedures to reduce risk of any “reasonably foreseeable event that might compromise safety or environmental protection.”</p>	<p>Must have emergency response and contingency plan for designating appropriate authority and appropriate response.</p> <p>Required to have regular training and drills for emergency response and evacuation.</p>	<p>Must prove to U.K. HSE that the safety plan contains a sufficient emergency and contingency plan.</p>	<p>Required to have plan in place to clean up any spills or leakage that would cause environmental harm.</p>	<p>Required to prepare a strategy for emergency preparedness against hazards and accidents.</p> <p>Risk analyses must be carried out to identify and assess contributions to major accident and environmental risk.</p>
	<p>Must have sufficient means to preserve lives and countermeasures to contain pollution.</p>	<p>The regulations do not specify requirements for means to preserve lives and countermeasures to contain pollution.</p>	<p>Must have sufficient means to preserve lives and countermeasures to contain pollution.</p>	<p>There are no specified requirements about preparation to preserve life in the event of an emergency, although such requirements could be included in a licence or an approval letter. The regulations only state that health and safety risks must be identified, assessed and reduced as much as is practically possible.</p>	<p>Must have sufficient means to preserve lives and countermeasures to contain pollution.</p>
6. Reporting and notification of accidents or	<p>The regulator must be notified of any “incident” or “near-</p>	<p>It is required to regularly report all incidents with serious</p>	<p>The operator is required to report all major incidents and</p>	<p>Any serious injury, loss of life, significant event or hazardous</p>	<p>The operator has the responsibility to immediately alert the</p>

Management Systems Requirements

emergencies	miss” to a person or property.	safety or environmental consequences to BOEMRE.	emergencies, however these are not contained within the safety case regulations. Management systems must have provisions to identify and control the risk of major accidents.	occurrence must be reported to the BMP immediately.	PSA of hazards and accidents. Damage to and incidents in connection with load bearing structures are specifically particularly required to be reported to the PSA.
	Management systems are required to have processes for the internal reporting and analysis of hazards and accidents.	BOEMRE requires that all incidents be properly and thoroughly investigated.	There are no specific requirements mandating internal reporting and review, only that installations must continually review their safety case and lower hazards and risks where practical.	There are no specific requirements mandating internal reporting and review, although such requirements could be included in a licence or an approval letter.	There are no specific requirements mandating internal reporting and review, only that installations must continually review their safety case and lower hazards and risks where practical.
7. Performance monitoring and compliance	Operator is responsible for reviewing and submitting an annual safety and environmental report to the NEB.	The lessee must review and report on the performance of their SEMS program at least annually.	The operators must undertake a periodic review of safety cases.	Licensees have the responsibility to regularly submit reports on the activities performed and their results.	The management system must be regularly reviewed. The review must report on compliance and improvement in HSE performance and to monitor trends in the level of risk.
	Provisions allowing the NEB to inspect an installation are not in the regulations governing management systems, but under the <i>Canada Oil and Gas Operations Act</i>	BOEMRE may evaluate or visit an installation to determine whether the lessee’s SEMS program is in place, addresses all required elements and its effectiveness.	There are no stated provisions in the management system regulations allowing U.K. HSE to visit and inspect an installation.	The government reserves right to access to all parts of enterprises and activities to inspect the installation and its operations.	There are no stated provisions in the management system regulations regarding allowing PSA to visit and inspect an installation.

Management Systems Requirements

	(Sections 53 to 58).				
	Management systems must be periodically reviewed or audited.	SEMS is must be regularly audited.	U.K. HSE requires regular audits and reports of an installation's safety case.	There are no stated provisions in regulations concerning requirements for installation's management system to be audited, although such requirements could be included in a licence or an approval letter.	Management systems must be periodically audited.

3.1 Overview of management systems

3.1.1 Canadian Arctic Offshore

The *Canada Oil and Gas Operations Act* requires that authorization be obtained from the NEB for any oil and gas activities in the Canadian Arctic offshore.⁹² To receive authorization to drill offshore for oil and gas, the *Canada Oil and Gas Drilling and Production Regulations*, the main body of regulation concerning authorization,⁹³ stipulate that the applicant for an authorization must have, among other things, a management system.⁹⁴ The *Canada Oil and Gas Drilling and Production Regulations* further require that once authorization is granted, the operator is responsible for ensuring conformity to the management system (where the operator is an applicant that has received authorization).⁹⁵

For authorization to be granted, the applicant's management system must include processes for:⁹⁶

- setting goals for the improvement of safety, environmental protection and waste prevention;
- identifying hazards and evaluating and managing the associated risks;
- ensuring that personnel are trained and competent to perform their duties;
- ensuring and maintaining the integrity of all facilities, structures, installations, support craft and equipment necessary to ensure safety, environmental protection and waste prevention;
- reporting and analyzing internally any incidents relating to health and safety and taking corrective actions to prevent their recurrence; and
- conducting periodic reviews or audits of the system and taking corrective actions if required.

The largest offshore installation disaster in Canadian waters was the *Ocean Ranger* disaster in 1982 off the coast of Newfoundland, where 84 crew members lost their lives and there were no survivors. The Royal Commission on the *Ocean Ranger* Marine Disaster (Hickman Report) resulted in a restructuring of the regulatory regime to a single regulator addressing safety and protection of the environment and influenced the management system regulations regarding personnel training and competency requirements and the evacuation and safety requirements.⁹⁷

⁹² Government of Canada, *Canada Oil and Gas Operations Act*, 1985 c. O-7, <http://laws-lois.justice.gc.ca/eng/acts/O-7/FullText.html>.

⁹³ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

⁹⁴ *Ibid.*, Section 5.

⁹⁵ *Ibid.*, Section 18.

⁹⁶ *Ibid.*, Section 5; this list of management system is not comprehensive, for a complete list the *Canada Oil and Gas Drilling and Production Regulations* should be consulted.

⁹⁷ Hickman et al., *Report One: The Loss of the Semisubmersible Drill Rig Ocean Ranger and its Crew* (Royal Commission on the *Ocean Ranger* Marine Disaster, 1984), 139; Sue Hart, "Safety and Industrial Relations in the Newfoundland Offshore Oil Industry Since the *Ocean Ranger* Disaster in 1982," *A Journal of Environmental and Occupational Health Policy* 10, no. 1-2 (2000).

3.1.2 United States

Since the *Deepwater Horizon* disaster on April 20, 2010, the Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) has begun to require operators of offshore installations to develop and implement Safety and Environmental Management Systems (SEMS) for oil, gas and sulphur operations in the Outer Continental Shelf (OCS).⁹⁸ The stated goal of the SEMS program “is to promote safety and environmental protection by ensuring all personnel aboard a facility are complying with the policies and procedures.”⁹⁹ A SEMS must identify, address, and manage safety, environmental hazards, and impacts during the design, construction, start-up, operation, inspection, and maintenance of all new and existing facilities, including mobile offshore drilling units (MODU).¹⁰⁰

A properly documented SEMS program must meet the following minimum criteria:

- “Safety and Environmental Information
- Hazards Analysis
- Job Safety Analysis
- Management of Change
- Operating Procedures
- Safe Work Practices
- Training
- Mechanical Integrity (Assurance of Quality and Mechanical Integrity of Critical Equipment)
- Emergency Response and Control
- Investigation of Incidents
- Auditing (Audit of Safety and Environmental Management Program Elements)
- Recordkeeping (Records and Documentation) and additional BOEMRE requirements.”¹⁰¹

Comparison to the Canadian Arctic Offshore

It is difficult to compare the SEMS regulations in the U.S. with similar regulations governing management systems in the Canadian Arctic since those in the U.S. are so new, and still under development. The new regulations in place in the U.S. appear comparable to the Canadian Arctic. The new regulations in the U.S. have become more performance-orientated, but it is difficult to judge whether one is more prescriptive than the other.

3.1.3 United Kingdom

The U.K. Health and Safety Executive (U.K. HSE) is the main governing body for offshore drilling operations. Offshore oil and gas activity has been underway in the U.K. for decades. The

⁹⁸ “Must I have a SEMS program?” U.S. Code of Federal Regulations Title 30, Pt. 250.1900.

⁹⁹ “What is the goal of my SEMS program?” U.S. Code of Federal Regulations Title 30, Pt. 250.1901.

¹⁰⁰ Ibid.

¹⁰¹ “What must I include in my SEMS program?” U.S. Code of Federal Regulations Title 30, Pt. 250.1902.

result is a complex regulatory system which has evolved over time in response to incidents and industry developments to prevent or mitigate the health and safety risks associated with offshore drilling. The principal regulatory document that governs management systems, referred to as ‘safety cases’ in the U.K., is the *Offshore Installations (Safety Case) Regulations 2005* (OSCR).¹⁰² In brief, this document requires operators of an offshore installation to prepare a safety case that provides evidence that all major accident risks have been evaluated and measures have been taken to control the risks. This must be submitted to the U.K. HSE for acceptance before a rig drills in U.K. waters. The OSCR does not directly prescribe specific requirements for the safety case; however, it refers a wide body of other regulations that are prescriptive that a safety case must adhere to. These regulations include:¹⁰³

- The *Offshore Installations and Pipeline Works (Management and Administration) Regulations 1995* (MAR) — which set out requirements for the safe management of offshore installations;¹⁰⁴
- The *Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995* (PFEER) — which provide for the protection of people from fire and explosion, and for securing an effective emergency response;¹⁰⁵
- The *Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996* (DCR) — which set out the requirements for the integrity of installations and the safety of offshore and onshore wells;¹⁰⁶ and
- *Offshore Installations (Safety Representatives and Safety Committees) Regulations 1989* (OSRSCR) — which place duties on offshore installation managers, owners and operators to establish arrangements for consultation with workers. These regulations apply to the workforce on the installation regardless of their employer's identity.¹⁰⁷

Moreover, the OSCR do not set standards for the control of major accident risks; these are set by the *Health and Safety at Work etc. Act 1974* (the *HSW Act*), the PFEER and the DCR.¹⁰⁸ The duty holder's safety case must demonstrate that the duty holder has arrangements in place which, if implemented, are capable of achieving compliance with all these legal objectives.¹⁰⁹

¹⁰² Government of the U.K., *The Offshore Installations (Safety Case) Regulations 2005*, Statutory Instrument 2005, No. 3117, <http://www.legislation.gov.uk/uksi/2005/3117/made>.

¹⁰³ U.K. Health and Safety Executive, *A Guide to the Offshore Installations (Safety Case) Regulations 2005*, 2006, <http://www.hse.gov.uk/pubns/priced/130.pdf>.

¹⁰⁴ Government of the U.K., *The Offshore Installations and Pipeline Works (Management and Administration) Regulations 1995*, Statutory Instrument 1995/738, <http://www.legislation.gov.uk/uksi/1995/738/contents/made>.

¹⁰⁵ Government of the U.K., *The Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995*, Statutory Instrument 1995/743, <http://www.legislation.gov.uk/uksi/1995/743/contents/made>.

¹⁰⁶ Government of the U.K., *The Offshore Installations and Wells (Design and Construction etc.) Regulations 1996*, Statutory Instrument 1996/913, <http://www.legislation.gov.uk/uksi/1996/913/contents/made>.

¹⁰⁷ Government of the U.K., *The Offshore Installations (Safety Representatives and Safety Committees) Regulations 1989*, <http://www.legislation.gov.uk/uksi/1989/971/contents/made>.

¹⁰⁸ Government of the U.K., *The Health and Safety at Work etc. Act 1974*, Statutory Instrument 1974, c. 37, <http://www.legislation.gov.uk/ukpga/1974/37>

¹⁰⁹ U.K. Health and Safety Executive, *A Guide to the Offshore Installations (Safety Case) Regulations 2005*.

Since the OSCR do not directly give prescriptive requirements for a safety case, the U.K. regulations are considered performance-based.

The required safety case, mandated by the OSCR, is a result of the central recommendation of Lord Cullen's report on the public inquiry into the *Piper Alpha* disaster.¹¹⁰ This recommendation was that the operator or owner of every offshore installation should be required to prepare a safety case and submit it to U.K. HSE for acceptance. Contained within the safety case must be a description of the duty holder's¹¹¹ management system.

Comparison to the Canadian Arctic Offshore

The regulations in the U.K. concerning safety cases are comparable to the regulations governing management systems in the Canadian Arctic offshore. In each area of regulation, the requirements for both systems are similar; however, U.K. regulations are more detailed than in the Canadian Arctic offshore. This is attributable to the U.K.'s greater experience in regulating offshore drilling, including the repercussions of a major disaster in their waters. Another, somewhat more subtle difference is that the U.K. regulations are more goal-based, where the Canadian regulations appear relatively more prescriptive.

3.1.4 Greenland

As mentioned in previous chapters, the Greenland regulatory regime for offshore oil and gas operations is in its infancy. Its only regulations are housed in the *Greenland Parliament Act of 7 December 2009* on mineral resources and mineral resource activities (the *Mineral Resources Act*).¹¹² Greenland Bureau of Minerals and Petroleum (BMP), the governing authority for offshore oil and gas activity, has also established guidelines (Exploration Drilling Guidelines)¹¹³ that the industry is expected to follow that elaborate upon the requirements contained in the *Greenland Minerals Resources Act*. The Exploration Drilling Guidelines are "considered minimum requirements and are mandatory unless deviations are specifically approved."¹¹⁴

Unlike the Canadian Arctic offshore, there is no stated requirement for a management system in the *Mineral Resources Act*. However, there are general requirements in the Act that state that "exploitation must be carried out in a sound manner with regard to safety, health and the environment . . . and according to acknowledged best international practices under similar conditions."¹¹⁵ This and other health and safety requirements contained in the Act are interpreted

¹¹⁰ The Honourable Lord Cullen, *The Public Inquiry into the Piper Alpha Disaster* (HM Stationery Office, 1990).

¹¹¹ In relation to a production installation, the term "duty holder" means the operator, and in relation to a non-production installation the term refers to the owner.

¹¹² Greenland Self Government, *Greenland Parliament Act of 7 December 2009 on Mineral Resources and Mineral Resource Activities (The Mineral Resources Act)*, 2009,

http://www.bmp.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf.

¹¹³ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010,

http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf.

¹¹⁴ Pers. Comm., Maja Sofie Burggaard, Special Advisor, Licence Department; Petroleum Section, Bureau of Minerals and Petroleum, Greenland Self-Government, May 5, 2011.

¹¹⁵ Greenland Self Government, *Mineral Resources Act*, Section 1(2).

by the March 2010 Exploration Drilling Guidelines to mean that “the Operator must have a recognized and documented health, safety and environment (HSE) Management System.”¹¹⁶ Furthermore, an information document released by the BMP states that in order for approval to be granted the applicant must have a sufficient HSE management system.¹¹⁷ “This system must ensure adequate environmentally appropriate oil exploration and exploitation. The documentation must also contain a review of the applicant’s emergency response plans and the applicant’s previous experience in managing environmental emergency situations.”¹¹⁸

Comparison to the Canadian Arctic Offshore

Greenland’s regulations are significantly different to Canada’s National Energy Board’s regulations. Regulations in the Canadian Arctic offshore have more explicit regulations on the various components for management systems. Regulations in Greenland cannot be considered prescriptive, since they rely on installations following “acknowledged international best practices.”¹¹⁹

3.1.5 Norway

In Norway, the requirements for management systems are contained in the *Framework Regulations*,¹²⁰ the *Management Regulations*,¹²¹ the *Activities Regulations*,¹²² and the *Information Duty Regulations*.¹²³ Under these regulations it is required that the “responsible party”¹²⁴ (or operator in the Canadian context), must establish a management system designed to ensure compliance with requirements in the health, safety and environment (HSE) legislation,¹²⁵ and must ensure that all contractors and suppliers and other participants have similar management systems that conform to the HSE regulations.

¹¹⁶ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, Section 1.0.

¹¹⁷ Greenland Bureau of Minerals and Petroleum, *Exploration and exploitation of hydrocarbons in Greenland Strategy for Licence Policy*, 2009, 30, http://www.bmp.gl/images/stories/about_bmp/publications/hydrocarbon_2009_uk.pdf.

¹¹⁸ Ibid.

¹¹⁹ Greenland Self Government, *Mineral Resources Act*, Section 1(2)

¹²⁰ Petroleum Safety Authority Norway, *Regulations Relating to Health, Safety and the Environment in the Petroleum Activities and at Certain Onshore Facilities (The Framework Regulations)*, 2010, <http://www.ptil.no/framework-hse/category403.html>.

¹²¹ Petroleum Safety Authority Norway, *Regulations Relating to Management and the Duty to Provide the Information in the Petroleum Activities and at Certain Onshore Facilities (The Management Regulations)*, 2010, <http://www.ptil.no/management/category401.html>.

¹²² Petroleum Safety Authority Norway, *Regulations Relating to Conducting Petroleum Activities (The Activities Regulations)*, 2010, <http://www.ptil.no/activities/category399.html>.

¹²³ Petroleum Safety Authority Norway, *Guidelines to Regulations Relation to Material and Information in the Petroleum Activities (The Information Duty Regulations)*, 2002, updated 2010, http://www.ptil.no/getfile.php/Regelverket/Opplysningspliktforskriften_Veiledning-2010_e.pdf.

¹²⁴ The “responsible party” is given to mean: “The operator and others participating in activities covered by these regulations, without being a licensee or owner of an onshore facility” (Petroleum Safety Authority Norway, *Framework Regulations*, Section 6(a)).

¹²⁵ Petroleum Safety Authority Norway, *Framework Regulations*, Section 17.

The Norwegian regulations place a heavy emphasis on requiring the responsible party to reduce risk and strategically manage acceptable risks. The management system is integral to this risk management. The *Alexander Kielland* disaster in 1980 was a principal motivation for the development of internal control, or management, systems and the current risk-based regulations.¹²⁶

Comparison to the Canadian Arctic Offshore

The management systems regulations in Norway are similar to those of the Canadian Arctic offshore and other jurisdictions, where systems are required to contain provisions to meet certain levels of health, safety and environmental requirements. The biggest difference between management system regulations in Norway and Canadian Arctic offshore is that Canadian Arctic regulations are much more prescriptive than Norway's. Norway's regulations are such that an installation and its operator must satisfactorily prove to the PSA that the installation and its management system mitigate all risks relating to the HSE requirements.¹²⁷ Canadian regulations contain more prescriptions for HSE requirements.

¹²⁶ Norwegian Petroleum Directorate. "Determined to learn from history," <http://www.npd.no/en/Publications/Norwegian-Continental-Shelf/No1-2010/Determined-to-learn-from-history/>

¹²⁷ Petroleum Safety Authority Norway, *Framework Regulations*, Section 11, <http://www.ptil.no/framework-hse/category403.html>.

3.2 Responsibilities

3.2.1 Canadian Arctic Offshore

In the Canadian Arctic offshore, the *Canada Oil and Gas Drilling and Production Regulations* stipulate that the applicant for an authorization has the responsibility for developing and enacting an effective management system,¹²⁸ and a safety plan and environmental protection plan, which are key parts of an effective management system.¹²⁹ The management system and adjoining safety and environmental protection plans must be submitted to the NEB for approval to drill.

Once an authorization is granted, it is the operator's responsibility to ensure compliance with the management system.¹³⁰ The *Canada Oil and Gas Drilling and Production Regulations* require that a specific individual be identified who is accountable for the establishment and maintenance of the management system.¹³¹

3.2.2 United States

In the United States, it is now required that the “lessee,¹³² the owner or holder of operating rights, or a designated operator or agent of the lessee(s) develop, implement, and maintain a SEMS program.”¹³³ This is the same in the Canadian Arctic offshore, where the ‘applicant’ is required to submit the management system. The SEMS must be submitted to BOEMRE to receive authorization to drill.¹³⁴

The SEMS must also be available to BOEMRE upon request after authorization is granted to ensure that it is adequately and periodically updated. It is the lessee that is responsible for “the development, support, continued improvement, and overall success of their SEMS program.”¹³⁵

Comparison to the Canadian Arctic Offshore

This requirement for the lessee to update and improve the SEMS is different from Canada's National Energy Board's requirement, where it is the operator's responsibility to review the management system.

¹²⁸ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 5, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

¹²⁹ *Ibid.*, Section 6.

¹³⁰ *Ibid.*, Section 18.

¹³¹ *Ibid.*, Sections 5(k), 8(f)(ii), 9(f)(ii).

¹³² The term “lessee” in the context of the U.S. means “a person who has entered into a lease with the United States to explore for, develop, and produce the leased minerals. The term lessee also includes the MMS-approved assignee of the lease, and the owner or the MMS-approved assignee of operating rights for the lease” (“Definitions,” U.S. Code of Federal Regulations Title 30, Pt. 250.105.).

¹³³ “Must I have a SEMS program?,” U.S. Code of Federal Regulations Title 30, Pt. 250.1900.

¹³⁴ “What must I include in my SEMS program?,” U.S. Code of Federal Regulations Title 30, Pt. 250.1902.

¹³⁵ “What are management's general responsibilities for the SEMS program?,” U.S. Code of Federal Regulations Title 30, Pt. 250.1909.

3.2.3 United Kingdom

In the U.K., the duty to submit the safety case for an installation is placed on the ‘duty holder’^{136, 137}. It is the responsibility of the licensee¹³⁸ to ensure that the duty holder that it appoints is capable of satisfactorily carrying out the necessary functions and discharging the required duties under the ‘relevant statutory provisions’,¹³⁹ including designing a sufficient safety case.¹⁴⁰

Following acceptance of safety cases, the operator has the responsibility to ensure that the installation is operated in conformity with the managing system and other arrangements described in the safety case.¹⁴¹ All parties involved in offshore operations, including contractors, have legal duties to co-operate with the safety case duty holder (Canadian Arctic : operator). When there are multiple duty holders, they must demonstrate to the U.K. HSE that their safety management systems operate effectively in conjunction with each other’s, who has primacy in emergencies, and who has overall responsibility for decision-making. “The [management] regime is regulated by U.K. HSE who can take formal enforcement action where duty holders’ performance falls short of that expected and poses serious risks.”¹⁴²

Comparison to the Canadian Arctic Offshore

The main difference from the regulatory system in Canadian Arctic offshore is that the ‘licensee’ (i.e. the party that holds the operating licence) and the ‘duty holder’ (i.e. the party appointed by the licensee to operate the offshore installation) is the same entity in Canadian Arctic offshore, referred to as the ‘operator.’

Another difference is the U.K. regulations allow multiple ‘operators’, or duty holders, of an installation (appointed by the licensee) to have individual management systems that work together. This differs from the model followed in Canadian Arctic offshore, where there is a single operator of an installation (who is also the licence holder) and a single management system for that installation to which all parties performing work on the installation must adhere.

¹³⁶ The expression ‘duty holder’ is given to mean in the OSCR as the person (whether the owner or the operator of an installation) on whom duties are placed by OSCR in respect of installations, particularly to prepare the safety case. (OSCR 2(1)). It does not mean that these are the only people with duties under health and safety law.

¹³⁷ U.K. Health and Safety Executive, *A Guide to the Offshore Installations (Safety Case) Regulations 2005*, 2006, <http://www.hse.gov.uk/pubns/priced/130.pdf>.

¹³⁸ The term ‘licensee’ means any person to whom a licence to search and bore for and get petroleum in respect of any area within relevant waters is granted (Government of the U.K., *The Offshore Installations (Safety Case) Regulations 2005*, Statutory Instrument 2005, No. 3117, Section 2(1), <http://www.legislation.gov.uk/ukSI/2005/3117/made>).

¹³⁹ The term ‘relevant statutory provisions’ is used to cover all the operator’s responsibilities under health and safety law (Government of the U.K., *The Offshore Installations (Safety Case) Regulations 2005*, Section 4.3.3).

¹⁴⁰ Government of the U.K., *The Offshore Installations (Safety Case) Regulations 2005*, Section 5(a).

¹⁴¹ *Ibis*, Section 12.

¹⁴² Government of the U.K., *Memorandum submitted by the Department of Energy and Climate Change, Health & Safety Executive, and Maritime and Coastguard Agency*, Section 37, <http://www.publications.parliament.uk/pa/cm201011/cmselect/cmenergy/450/450we10.htm>.

3.2.4 Greenland

In Greenland, legislation does not cover the management system requirements; however the March 2010 Exploration Drilling Guidelines state that the operator must have a recognized and documented HSE Management System prior to approval to drill.¹⁴³ The management system is required to follow what the government considers “international best practices.”

The Exploration Guidelines indicates that it is the BMP’s “duty” to ensure that the operator has the management system in place during drilling.¹⁴⁴ Additional requirements for management systems responsibilities can be specified in a licence or an approval letter from the BMP.

Comparison to the Canadian Arctic Offshore

The requirement in Greenland to follow international best practices for management systems is a significant deviation from the Canadian regulations, where the management system requirements are outlined in detail. The “duty” of the BMP to ensure that the management system is in place varies from all other jurisdictions, including Canadian Arctic offshore, where none of the regulators have the responsibility, or “duty,” to inspect a management system after approval is granted.

3.2.5 Norway

In Norway, it is required that the responsible party (Canadian Arctic : operator) must establish, follow up and further develop a management system designed to ensure compliance with requirements in the HSE legislation.¹⁴⁵

After approval is granted, it is the combined responsibility of the licensee and the operator to ensure that everyone who carries out work on the installation, including contractors and subcontractors, complies with the HSE requirements.¹⁴⁶

Comparison to the Canadian Arctic Offshore

The Norwegian system of combining responsibility between the licensee and the operator is similar to the Canadian model where this duty lies solely with the operator, who is also the holder of the operating licence.

¹⁴³ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, Section 1.0, http://www.bmp.gl/images/stories/petroleum/bmp_Exploration_Drilling_Guidelines_March_2010.pdf.

¹⁴⁴ Ibid.

¹⁴⁵ Petroleum Safety Authority Norway, *Regulations Relating to Health, Safety, and the Environment in the Petroleum Activities and at Certain Onshore Facilities (The Framework Regulations)*, 2010, Section 17, <http://www.ptil.no/framework-hse/category403.html>.

¹⁴⁶ Ibid., Section 7, 9.

3.3 Occupational health and safety

3.3.1 Canadian Arctic Offshore

The *Canada Oil and Gas Drilling and Production Regulations* stipulate that the applicant for authorization to develop a resource must have a management system and a safety plan. These documents provide the framework on which an applicant is to build its occupational health and safety regime. The *Canada Oil and Gas Drilling and Production Regulations* stipulate that the operator must take all reasonable precautions¹⁴⁷ to ensure safety.¹⁴⁸ Compared with the other jurisdictions, these requirements are more explicit and prescriptive in nature.

The management system of the resource developer is required to include adequate provision for occupational health and safety. Specifically, it is stipulated that the management system must include:

- “processes for setting goals for the improvement of safety;
- processes for identifying hazards and for evaluating and managing the associated risks;
- processes for ensuring and maintaining the integrity of all facilities, structures, installations, support craft and equipment necessary to ensure safety;

¹⁴⁷ Section 19 of the *Canada Oil and Gas Drilling and Production Regulations* states the “reasonable precautions” includes:

“(a) any operation necessary for the safety of persons at an installation or on a support craft has priority, at all times, over any work or activity at that installation or on that support craft;

(b) safe work methods are followed during all drilling, well or production operations;

(c) there is a shift handover system to effectively communicate any conditions, mechanical or procedural deficiencies or other problems that might have an impact on safety or environmental protection;

(d) differences in language or other barriers to effective communication do not jeopardize safety or environmental protection;

(e) all persons at an installation, or in transit to or from an installation, receive instruction in and are familiar with safety and evacuation procedures and with their roles and responsibilities in the contingency plans, including emergency response procedures;

(f) any drilling or well operation is conducted in a manner that maintains full control of the well at all times;

(g) if there is loss of control of a well at an installation, all other wells at that installation are shut in until the well that is out of control is secured;

(h) plans are in place to deal with potential hazards;

(i) all equipment required for safety and environmental protection is available and in an operable condition;

(j) the inventory of all equipment identified in the safety plan and the environmental protection plan is updated after the completion of any significant modification or repair to any major component of the equipment;

(k) the administrative and logistical support that is provided for drilling, well or production operations includes accommodation, transportation, first aid and storage, repair facilities and communication systems suitable for the area of operations;

(l) a sufficient number of trained and competent individuals are available to complete the authorized work or activities and to carry out any work or activity safely and without pollution; and

(m) any operational procedure that is a hazard to safety or the environment is corrected and all affected persons are informed of the alteration.”

¹⁴⁸ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 19, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

- processes for the internal reporting and analysis of hazards, minor injuries, incidents and near-misses and for taking corrective actions to prevent their recurrence;
- the documents describing all management system processes and the processes for making personnel aware of their roles and responsibilities with respect to them;
- arrangements for coordinating the management and operations of the proposed work or activity among the owner of the installation, the contractors, the operator and others, as applicable; and
- the name and position of the person accountable for the establishment and maintenance of the system and of the person responsible for implementing it.”¹⁴⁹

The safety plan sets out the procedures, practices, resources, sequence of key safety-related activities and monitoring measures necessary to ensure that the management system is adhered to during the proposed work or activity.¹⁵⁰

The operator is responsible for the management system and safety plan and for ensuring that all other safety requirements are met, at all times. This includes ensuring that:

- “safety operations on any installation or support craft take priority over any other activity;
- safe work methods are followed during all drilling, well or production operations;
- problems and safety issues are properly communicated during a shift change;
- all persons at an installation receive adequate instruction on safety procedures;
- plans are in place to deal with potential hazards;
- all equipment required for safety and environmental protection is available and in an operable condition; and
- a sufficient number of trained and competent individuals are available to complete the authorized work or activities and to carry out any work or activity safely and without pollution.”¹⁵¹

Under the *Canada Labour Code*, there exist further regulations respecting occupational health and safety for employees engaged in oil and gas development activities defined under the *Canada Oil and Gas Act*. These regulations are known as the *Oil and Gas Occupational Safety and Health Regulations*.¹⁵² While these regulations are required by law, they are not considered part of the management system required by the *Canada Oil and Gas Drilling and Production Regulations*.

3.3.2 United States

In the United States, the lessee’s SEMS program must “establish and implement safe work practices designed to minimize the risks associated with operating, maintenance, and

¹⁴⁹ Ibid., Section 5(2).

¹⁵⁰ Ibid., Section 8.

¹⁵¹ Ibid., Section 19.

¹⁵² Government of Canada, *Oil and Gas Occupational Safety and Health Regulations*, October 22, 1987, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-87-612/FullText.html>.

modification activities and the handling of materials and substances that could affect safety or the environment.”¹⁵³ An SEMS program must also document contractor¹⁵⁴ selection criteria.¹⁵⁵ When selecting a contractor, the lessee must obtain and evaluate information regarding the contractor's safety and environmental performance, as well as ensure that contractors have their own written safe work practices.¹⁵⁶

In their SEMS, the lessee must also develop and implement a hazards analysis at the facility level and a job safety analysis for all of their facilities.¹⁵⁷

The hazards analysis must address the following:

- hazards of the operation;
- previous incidents related to the operation;
- control technology applicable to the operation the hazards analysis is evaluating; and
- a qualitative evaluation of the possible safety and health effects on employees, and potential impacts to the human and marine environments, which may result if the control technology fails.

The job safety analysis must identify, analyze, and record:

- the steps involved in performing a specific job;
- the existing or potential safety and health hazards associated with each step; and
- the recommended action(s)/procedure(s) that will eliminate or reduce these hazards and the risk of a workplace injury or illness.

Comparison to the Canadian Arctic Offshore

These analyses differ from the more prescriptive work safety requirements of Canadian Arctic offshore. In the U.S, the SEMS is based on these analyses of the risks and hazards. Canada’s National Energy Board does not require as extensive of an analysis of hazards and risks, but prescribes the areas relating to occupational health and safety that need to be regulated.

3.3.3 United Kingdom

While the OSCR are the principle regulations concerning offshore oil and gas safety in the U.K., the OSCR only covers major hazard aspect of design,¹⁵⁸ where it is specified that the risks of

¹⁵³ “What criteria must be documented in my SEMS program for safe work practices and contractor selection?,” U.S. Code of Federal Regulations Title 30, Pt. 250.1914.

¹⁵⁴ A contractor is defined as “anyone performing work for the lessee” (Ibid.).

¹⁵⁵ Ibid.

¹⁵⁶ Ibid.

¹⁵⁷ “What criteria for hazards analyses must my SEMS program meet?,” U.S. Code of Federal Regulations Title 30, Pt. 250.1911.

¹⁵⁸ “Major accidents” are defined by the regulations as:

“(a) a fire, explosion or the release of a dangerous substance involving death or serious personal injury to persons on the installation or engaged in an activity on or in connection with it;

major hazards must be identified and evaluated in the safety case.¹⁵⁹ Beyond the ‘major hazard risks,’ the OSCR does not set specific requirements. Less hazardous aspects of occupational health and safety must also be accounted for in the safety case, as contained the “relevant statutory provisions,” which refers to Part I of the *HSW Act* and regulations made under the Act, which include:¹⁶⁰

- *Management of Health and Safety at Work Regulations 1999*,
- *Offshore Installations and Pipeline Works (Management and Administration) Regulations 1995 (MAR)*,
- *Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995 (PFEER)*,
- *Offshore Installations (Design and Construction, etc.) Regulations 1996 (DCR)*,
- *Pipelines Safety Regulations 1996*,
- *Provision and Use of Work Equipment Regulations 1998*,
- *Lifting Operations and Lifting Equipment Regulations 1998*,
- *Control of Substances Hazardous to Health Regulations updated in 2002*,
- *Noise at Work Regulations 2005*, and
- the remaining provisions of older offshore-specific health and safety legislation, such as *Offshore Installations (Safety Representatives and Safety Committees) Regulations 1989* and the provisions on safety zones under the *Petroleum Act 1987*.

These regulations implement the relevant *European Directive 92/91/EEC* on the minimum requirements for improving the safety and health of workers in the mineral-extracting industries through drilling.¹⁶¹

(b) any event involving major damage to the structure of the installation or plant affixed thereto or any loss in the stability of the installation;

(c) the collision of a helicopter with the installation;

(d) the failure of life support systems for diving operations in connection with the installation, the detachment of a diving bell used for such operations or the trapping of a diver in a diving bell or other subsea chamber used for such operations; or

(e) any other event arising from a work activity involving death or serious personal injury to five or more persons on the installation or engaged in an activity in connection with it.” (Government of the U.K., *The Offshore Installations (Safety Case) Regulations 2005*, Statutory Instrument 2005, No. 3117, Section 2, <http://www.legislation.gov.uk/uksi/2005/3117/made>.)

¹⁵⁹ “The 1992 OSCR required a safety case to include a demonstration that major hazard risks are ALARP. Instead, the 2005 OSCR require the safety case to demonstrate that major hazard risks are identified and evaluated and that, in respect of these risks, the ‘relevant statutory provisions’ will be complied with. This is more consistent with the principle that OSCR does not set standards for the control of major accident risks. In practice the ALARP standard remains for acceptance except where the law requires a stronger standard.” (U.K. Health and Safety Executive, *A Guide to the Offshore Installations (Safety Case) Regulations 2005*, 2006, <http://www.hse.gov.uk/pubns/priced/130.pdf>.)

¹⁶⁰ Government of the U.K., *The Health and Safety at Work etc. Act 1974*, Statutory Instrument 1974, c. 37, <http://www.legislation.gov.uk/ukpga/1974/37>.

¹⁶¹ Government of the U.K., *Memorandum submitted by the Department of Energy and Climate Change, Health & Safety Executive, and Maritime and Coastguard Agency*, Section 43, <http://www.publications.parliament.uk/pa/cm201011/cmselect/cmenergy/450/450we10.htm>.

Comparison to the Canadian Arctic Offshore

These ‘relevant statutory provisions’ are prescriptive in nature and a safety case must prove that the prescriptions therein will be met. This differs from the regulatory requirements in Canadian Arctic offshore, where most of the requirements for the management system are contained in the same body of regulations that mandate the need for a management system.

3.3.4 Greenland

In Greenland, the licensee has the responsibility to “ensure that health and safety risks in relation to offshore exploration or exploitation of hydrocarbons have been identified, assessed and reduced as much as is practically possible.”¹⁶²

The March 2010 Exploration Drilling Guidelines state that “operators are expected to demonstrate they have a Safety Management System and to describe how safety management, including the co-ordination of the safety management programs of the major contractors, fits within the overall management of the program.”¹⁶³ In the Safety Management System, the BMP expects operators to identify all hazards associated with drilling and to ensure that appropriate measures are in place to manage and control the hazards.

“In addition, in line with the Safety Management System the following programmes need to be in place and demonstrable:

- Safety Programmes, such as STOP etc.
- Permit to Work (PTW) programme
- Evacuation Systems and Programmes
- Maintenance Programmes
- Qualification and Certification of key personnel
- H₂S Awareness and Emergency Response Planning”¹⁶⁴

Also, additional requirements for occupational health and safety can be specified in a licence or an approval letter from the BMP.

Comparison to the Canadian Arctic Offshore

The main difference between the management systems in Greenland and the Canadian Arctic offshore is that in the Canadian Arctic the requirements for management systems are prescribed in detail, including specific requirements that must be met with regards to occupational health and safety. Alternatively, in Greenland occupational health and safety standards are ‘programs,’ rather than ‘requirements,’ that copy “international best practices.”

¹⁶² Greenland Self Government, *Greenland Parliament Act of 7 December 2009 on Mineral Resources and Mineral Resource Activities (The Mineral Resources Act)*, Section 79(1),

http://www.bmp.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf

¹⁶³ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, Section 1.2, http://www.bmp.gl/images/stories/petroleum/bmp_Exploration_Drilling_Guidelines_March_2010.pdf.

¹⁶⁴ Ibid.

3.3.5 Norway

In Norway, management systems are required to contain numerous provisions for what in the Canadian Arctic offshore regulations is referred to as occupational health and safety.¹⁶⁵ The majority of these regulations are contained in the *Framework Regulations*, and where other regulations specify requirements therein, they refer back to the *Framework Regulations*.

Specifically, it is required “that harm or danger of harm to people, the environment or material assets shall be prevented or limited in accordance with HSE legislation”¹⁶⁶ and, where possible, risks must be further reduced. Similarly, regulation specifies that “factors that could cause harm or disadvantage to people, the environment or material assets in the petroleum activities, shall be replaced by factors that, in an overall assessment, have less potential for harm or disadvantage.”¹⁶⁷

To reduce risks and improve HSE conditions, employees and their elected representatives must be provided the opportunity to participate in the establishment, follow-up and further development of management systems.¹⁶⁸ Moreover, the employee’s elected representative can demand that a work operation or work process be halted by the operator, wherein the operation or work shall stop immediately if the safety delegate does not accept the implementation of alternative measures.¹⁶⁹

Health-related matters are required to be “safeguarded in a prudent manner during all phases of the offshore petroleum activities,”¹⁷⁰ and the responsible party must ensure a sound health service for anyone who stays on facilities participating in offshore petroleum activities. “The health service shall comprise preventive measures and provide curative services.”¹⁷¹

Comparison to the Canadian Arctic Offshore

As compared to the Canadian Arctic offshore, Norway includes a number of HSE requirements within the management system, and requires that management system must ensure compliance with other HSE requirements.

¹⁶⁵ In Norway occupational health and safety is generally referred to as health, safety and environment legislation (or objectives).

¹⁶⁶ Petroleum Safety Authority Norway, *Regulations Relating to Health, Safety, and the Environment in the Petroleum Activities and at Certain Onshore Facilities (The Framework Regulations)*, 2010, Section 11, <http://www.ptil.no/framework-hse/category403.html>.

¹⁶⁷ Ibid.

¹⁶⁸ Ibid., Section 12,15.

¹⁶⁹ Ibid., Section 35.

¹⁷⁰ Ibid., Section 16.

¹⁷¹ Ibid.

3.4 Personnel competence and training

3.4.1 Canadian Arctic Offshore

The *Canada Oil and Gas Drilling and Production Regulations* require that an installation's management system contain provisions to ensure that personnel are trained and competent to perform their duties¹⁷² and that there are a sufficient number of trained and competent individuals in order to complete any activity safely and without pollution.¹⁷³ The management system is also required to contain the documents describing all the processes for making personnel aware of their roles and responsibilities.¹⁷⁴

Under the *Canada Oil and Gas Operations Act* the NEB may consider training and competency of personnel before granting authorization.¹⁷⁵

3.4.2 United States

One of the stated purposes of the SEMS program is to ensure that “all personnel involved must be trained to have the skills and knowledge to perform their assigned duties.”¹⁷⁶ This includes requirements that the lessee must:

- “utilize personnel with expertise in identifying safety hazards, environmental impacts, optimizing operations, developing safe work practices, developing training programs and investigating incidents”;¹⁷⁷
- “ensure that suitably trained and qualified personnel are employed to carry out all aspects of the SEMS program”;¹⁷⁸
- “implement a training program so that all personnel are trained to work safely and are aware of environmental considerations offshore, in accordance with their duties and responsibilities”;¹⁷⁹ and
- “ensure that contractors have the skills and knowledge to perform their assigned duties and are conducting these activities in accordance with the requirements of the SEMS.”¹⁸⁰

¹⁷² Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 5(2)(d), <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

¹⁷³ Ibid., Section 19(1).

¹⁷⁴ Ibid., Section 5(2)(g).

¹⁷⁵ Government of Canada, *Canada Oil and Gas Operations Act c. O-7*, 1985, Section 5, <http://laws-lois.justice.gc.ca/eng/acts/O-7/FullText.html?term=response>.

¹⁷⁶ “What is the goal of my SEMS program?” U.S. Code of Federal Regulations Title 30, Pt. 250.1901.

¹⁷⁷ “What are management’s general responsibilities for the SEMS program?” U.S. Code of Federal Regulations Title 30, Pt. 250.1909(f).

¹⁷⁸ Ibid., Pt. 250.1909(i).

¹⁷⁹ “What criteria for training must be in my SEMS program?” U.S. Code of Federal Regulations Title 30, Pt. 250.1915.

¹⁸⁰ “What criteria must be documented in my SEMS program for safe work practices and contractor selection?” U.S. Code of Federal Regulations Title 30, Pt. 250.1914(c)(2).

Comparison to the Canadian Arctic Offshore

While these regulations are similar to in the Canadian Arctic offshore in their requirement to have qualified operation personnel, they differ in their lack of requirement of a minimum number of workers for hazardous operations.

3.4.3 United Kingdom

Section 5 of the *Offshore Installations (Safety Case) Regulations* specify that it is the duty of the licensee “to ensure that any operator appointed by him is capable of satisfactorily carrying out his functions and discharging his duties under the relevant statutory provisions.”¹⁸¹ The guidelines for the OSCR interpret this requirement that “being capable includes having the technical and managerial capacity to do the job, as well as being adequately resourced, both financially and in having sufficient competent staff.”¹⁸² Similarly, it is the duty of the duty holder (Canadian Arctic : operator) to appoint a competent and adequately resourced installation manager.¹⁸³ Duty holders must be able to demonstrate appropriate crew training, and the ensure that crews understand the decision-making procedures for events that may occur during the well construction and operation. The operator must also ensure that contractors and suppliers are qualified and competent.¹⁸⁴

Comparison to the Canadian Arctic Offshore

There is little difference between these regulations in the U.K. and those in Canadian Arctic offshore.

3.4.4 Greenland

It is specified in the *Mineral Resources Act* that to reduce environmental risks “as much as practically possible,” the employer must ensure that an employee receives the necessary training and instructions in performing the work.¹⁸⁵ The March 2010 Exploration Drilling Guidelines indicate that the operator must make available to BMP all records of employee competence, especially the qualifications of key personnel.¹⁸⁶ Also, additional requirements for personnel competence and training can be specified in a licence or an approval letter from the BMP.

¹⁸¹ Government of the U.K., *The Offshore Installations (Safety Case) Regulations 2005*, Statutory Instrument 2005, No. 3117, Section 5, <http://www.legislation.gov.uk/ukxi/2005/3117/made>.

¹⁸² U.K. Health and Safety Executive, *A Guide to the Offshore Installations (Safety Case) Regulations 2005*, 2006, <http://www.hse.gov.uk/pubns/priced/130.pdf>.

¹⁸³ Government of the U.K., *The Offshore Installations and Pipeline Works (Management and Administration) Regulations 1995 (MAR)*, Statutory Instrument 1995, SPC/Enforcement/153, Section 6, <http://www.legislation.gov.uk/ukxi/1995/738/contents/made>.

¹⁸⁴ *Ibid.*, Section 12.

¹⁸⁵ Greenland Self Government, *Greenland Parliament Act of 7 December 2009 on Mineral Resources and Mineral Resource Activities (The Mineral Resources Act)*, Section 53(5)(iv) http://www.bmp.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf.

¹⁸⁶ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, Appendix B, http://www.bmp.gl/images/stories/petroleum/bmp_Exploration_Drilling_Guidelines_March_2010.pdf.

Comparison to the Canadian Arctic Offshore

This differs for the Canadian regulations for personnel, in that a minimum number of workers to complete high risk activities are not specified in the regulations and guidelines of Greenland.

3.4.5 Norway

In Norway, the “responsible party [Canadian Arctic : operator] is required to ensure that the personnel at all times have the competence necessary to carry out the activities in accordance with the HSE legislation.”¹⁸⁷ Particularly, regulations require a sufficient number of personnel and competence to safeguard functions: “a) where mistakes may have serious consequences for HSE, and b) that reduce the probability of mistakes and hazard and accident situations developing.”¹⁸⁸

It is further required that when entering into a contract, the responsible party must ensure that the contractors and suppliers are qualified to fulfill the regulatory requirements relating to HSE. The responsible party is also required to follow up to ensure that the participants comply with the requirements while performing their assignments.¹⁸⁹

The responsible party must ensure that necessary training and necessary exercises are conducted, so that the personnel are always able to handle operational disturbances, hazards and potential accidents in an effective manner.¹⁹⁰

Comparison to the Canadian Arctic Offshore

There is little difference between these regulations in Norway and those in Canadian Arctic offshore. Norwegian regulations place more responsibility for verification of worker competency on the operator, rather than the regulator.

¹⁸⁷ Petroleum Safety Authority Norway, *Regulations Relating to Health, Safety, and the Environment in the Petroleum Activities and at Certain Onshore Facilities (The Framework Regulations)*, 2010, Section 12, <http://www.ptil.no/framework-hse/category403.html>.

Petroleum Safety Authority Norway, *Regulations Relating to Conducting Petroleum Activities (The Activities Regulations)*, 2010, Section 21, <http://www.ptil.no/activities/category399.html>.

¹⁸⁸ Petroleum Safety Authority Norway, *Regulations Relating to Management and the Duty to Provide Information in the Petroleum Activities and at Certain Onshore Facilities (The Management Regulations)*, 2010, Section 14, <http://www.ptil.no/management/category401.html>

¹⁸⁹ Petroleum Safety Authority Norway, *Framework Regulations*, Section 18.

¹⁹⁰ Petroleum Safety Authority Norway, *Activities Regulations*, Section 23.

3.5 Emergency preparedness

3.5.1 Canadian Arctic Offshore

The *Canada Oil and Gas Drilling and Production Requirements* require that management systems contain processes for “identifying any hazards and managing the associated risks.”¹⁹¹ The application for authorization must have “contingency plans, including emergency response procedures, to mitigate the effects of any reasonably foreseeable event that might compromise safety or environmental protection.”¹⁹² These contingency plans and emergency response procedures must contain provisions for:

- coordination with any relevant government emergency response plan;¹⁹³
- “identify[ing] the scope and frequency of the field practice exercise of oil spill countermeasures”;¹⁹⁴
- “training all persons at an installation, or in transit to or from an installation, such that they are familiar with safety and evacuation procedures and with their roles and responsibilities in the contingency plans and emergency response procedures”;¹⁹⁵
- having “sufficient quantities of fuel, potable water, spill containment products, safety-related chemicals, drilling fluids, cement and other consumables readily available”;¹⁹⁶
- being “suitably equipped to supply the necessary emergency services including rescue and first aid treatment for all personnel.”¹⁹⁷

There exist further regulations, separate from the management system requirements, that prescribe in great detail all of the safety and emergency requirements that must be met on an installation. These prescriptive requirements are housed in the *Canada Oil and Gas Installations Regulations*.¹⁹⁸

3.5.2 United States

In the U.S., the lessee must include in its SEMS procedures to ensure that management of safety hazards and environmental impacts is an integral part of the design, construction, maintenance,

¹⁹¹ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 5(2)(c), <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

¹⁹² Ibid., Section 6(j).

¹⁹³ Ibid., Section 6(j)(i)

¹⁹⁴ Ibid., Section 6(j)(ii).

¹⁹⁵ Ibid., Section 19(e).

¹⁹⁶ Ibid., Section 22(a).

¹⁹⁷ Ibid., Section 70(b).

¹⁹⁸ Government of Canada, *Canada Oil and Gas Installations Regulations*, 1996, SOR/96-118, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-118/FullText.html>

operation, and monitoring of each facility.¹⁹⁹ The SEMS emergency response and control plans must include:

- “Emergency Action Plan that assigns authority and responsibility to the appropriate qualified person(s) at a facility for initiating effective emergency response and control, addressing emergency reporting and response requirements, and complying with all applicable governmental regulations;
- Emergency Control Center(s) designated for each facility with access to the Emergency Action Plans, oil spill contingency plan, and other safety and environmental information; and
- Training and Drills incorporating emergency response and evacuation procedures conducted periodically for all personnel (including contractor's personnel), as required by the SEMS training program (see Section 4.4.2). Drills must be based on realistic scenarios conducted periodically to exercise elements contained in the facility or area emergency action plan. An analysis and critique of each drill must be conducted to identify and correct weaknesses.”²⁰⁰

Comparison to the Canadian Arctic Offshore

These regulations differ from in the Canadian Arctic offshore in that they do not specify requirements for means to preserve lives and countermeasures to contain pollution.

3.5.3 United Kingdom

The OSCR identifies the need for the safety case to include appropriate emergency management systems “to give confidence to both the duty holder and the U.K. HSE that the duty holder has the ability and means to control major accident risks effectively.”²⁰¹ This requirement is in place to provide an extra level of regulatory control on beyond regulations like the PFEER and the DCR.²⁰² For example, there must be management arrangements for evacuation, escape and rescue in an emergency.

PFEER requires measures to prevent fires and explosions on offshore installations, to protect people from the effects of any which do occur and to secure effective emergency response. The organization and arrangements to meet these requirements will form part of the management system for the purposes of the safety case demonstration under OSCR regulation 12(1)(a).

Comparison to the Canadian Arctic Offshore

There is little difference between these regulations in the U.K. and those in Canadian Arctic offshore.

¹⁹⁹ “What are management’s general responsibilities for the SEMS program?” U.S. Code of Federal Regulations Title 30, Pt. 250.1909(h).

²⁰⁰ “What criteria for emergency response and control must be in my SEMS program?” U.S. Code of Federal Regulations Title 30, Pt. 250.1918(a),(b),(c).

²⁰¹ U.K. Health and Safety Executive, *A Guide to the Offshore Installations (Safety Case) Regulations 2005, 2006*, <http://www.hse.gov.uk/pubns/priced/130.pdf> .

²⁰² Ibid.

3.5.4 Greenland

While they are not referred to as such in the *Mineral Resources Act*, the Act requires that an operator must have an emergency response plan in place that addresses procedures for containing and cleaning up possible large oil spills. “Minor spills must be managed by the company by means of clean-up equipment placed at a central and appropriate location in relation to the drilling operations. For major spills, efforts by the responsible company are supplemented by international emergency response companies with special skills, and by the authorities in the countries likely to be affected by the incident.”²⁰³ The guidelines of offshore installations explain:

As a minimum, the operator's oil emergency response plans must include a description of the organization, personnel, alarm and warning procedures, abatement strategies and location of equipment, communication set-up, indication of where possible major oil spills will be contained and cleaned up, procedures for disposal of collected oil, surveillance of the extent of spills, protection and clean-up of coasts. Moreover, cooperating with the authorities, operators must develop long-term monitoring plans aimed at monitoring concentrations of oil and environmental impacts resulting from oil spills.²⁰⁴

The Act also states that “the licensee must ensure that the health and safety risks are identified, assessed and reduced as much as is practically possible”²⁰⁵ Beyond this, there are no stated requirements for emergency preparedness with regards to health and safety. Additional requirements for emergency preparedness can be specified in a licence or an approval letter from the BMP.

Comparison to the Canadian Arctic Offshore

Greenland’s regulations concerning emergency preparedness are significantly different from in the Canadian Arctic offshore. For example, Greenland has no specified requirements about preparation to preserve life in the event of an emergency; rather, offshore installations are required to follow international best practice.

3.5.5 Norway

The regulations in Norway stipulate that the party responsible for operating an installation (Canadian Arctic : operator) must “prepare a strategy for emergency preparedness against hazard and accident situations.”²⁰⁶ The emergency preparedness strategy is required to be established on

²⁰³ Greenland Bureau of Minerals and Petroleum, *Exploration and exploitation of hydrocarbons in Greenland Strategy for Licence Policy*, 2009, 30, http://www.bmp.gl/images/stories/about_bmp/publications/hydrocarbon_2009_uk.pdf.

²⁰⁴ Ibid.

²⁰⁵ Greenland Self Government, *Greenland Parliament Act of 7 December 2009 on Mineral Resources and Mineral Resource Activities (The Mineral Resources Act)*, Section 79(3) http://www.bmp.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf

²⁰⁶ Petroleum Safety Authority Norway, *Regulations Relating to Conducting Petroleum Activities (The Activities Regulations)*, 2010, Section 73, <http://www.ptil.no/activities/category399.html>.

the basis of results from “risk and emergency preparedness analyses.”²⁰⁷ The risk analyses are to provide “a balanced and most comprehensive as possible picture of the risk associated with the activities, and the analyses shall be appropriate as regards providing support for decisions related to the upcoming operation or phase.”²⁰⁸ Risk analyses must be carried out to identify and assess contributions to major accident and environmental risk, as well as ascertain the effects various operations and modifications will have on major accident and environmental risk.

Comparison to the Canadian Arctic Offshore

These regulations are less prescriptive than in the Canadian Arctic offshore but otherwise there is little difference between the two jurisdictions.

²⁰⁷ Ibid.

²⁰⁸ Petroleum Safety Authority Norway, *Regulations Relating to Management and the Duty to Provide Information in the Petroleum Activities and at Certain Onshore Facilities (The Management Regulations)*, 2010, Section 17, <http://www.ptil.no/management/category401.html> .

3.6 Reporting and notification of accidents or emergencies

3.6.1 Canadian Arctic Offshore

The *Canada Oil and Gas Drilling and Production Regulations* mandate that management systems for installations in the Canadian Arctic contain “processes for the internal reporting and analysis of hazards, minor injuries, incidents and near-misses and for taking corrective actions to prevent their recurrence.”²⁰⁹

In the event of an accident or emergency, an operator of offshore installation must inform the Chief Safety Officer of the NEB “by the most rapid and practical means, of any situation or event involving any danger or accident to a person or property, including loss of life, a missing person, serious injury to a person, an imminent threat to safety of personnel or the public, fire, explosion, loss of well control, hydrocarbon or toxic fluid spills, or significant damage to a pipeline, equipment or an installation.”²¹⁰

The operator of an installation is also required to notify NEB of “any incident or near-miss as soon as the circumstances permit.”²¹¹ ²¹² NEB must also be “notified at least 24 hours in advance of any press release or press conference held by the operator concerning any incident or near-miss during any activity, except in an emergency situation, in which case it shall be notified without delay before the press release or press conference.”²¹³

3.6.2 United States

“To learn from incidents and help prevent similar incidents, an SEMS program must establish procedures for investigation of all incidents with serious safety or environmental consequences.”²¹⁴ It is also required that SEMS provide for investigation of incidents that are determined by BOEMRE to have possessed the potential for serious safety or environmental consequences. BOEMRE requires that incident investigations be initiated as promptly as

²⁰⁹ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, SOR/2009-315, 2009, Section 5(2)(f), <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

²¹⁰ Government of Canada, *Canada Oil and Gas Installations Regulations*, SOR/96-118, 1996, Section 71(1), <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-118/FullText.html>.

²¹¹ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, Section 75(1)(a).

²¹² The Drilling and Production Regulations define an ‘incident’ as: “any event that causes a lost or restricted workday injury, death, fire or explosion, a loss of containment of any fluid from a well, an imminent threat to the safety of a person, installation or support craft, or pollution; any event that results in a missing person; or any event that causes the impairment of any structure, facility, equipment or system critical to the safety of persons, an installation or support craft, or the impairment of any structure, facility, equipment or system critical to environmental protection (Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, SOR/2009-315, 2009, Section 1, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>)

²¹³ Ibid., Section 75(1)(b).

²¹⁴ “What criteria for investigation of incidents must be in my SEMS program?,” U.S. Code of Federal Regulations Title 30, Pt. 250.1919.

possible, with due regard for the necessity of securing the incident scene and protecting people and the environment.²¹⁵

Comparison to the Canadian Arctic Offshore

There is little difference between these regulations in the U.S. and those in Canadian Arctic offshore.

3.6.3 United Kingdom

Under the OSCR, it is required that the management systems have provisions to identify and control the risk of major accidents,^{216,217} however the OSCR do not set standards for the control of major accident risks. These are set by PFEER, DCR and other regulations, as well as by the *Health and Safety at Work Act 1974*. The safety case and management systems must show that they meet all of the extensive requirements therein.

It is specified that the safety case must “establish adequate arrangements for audits and for the making of reports” pursuant to health and safety.²¹⁸ The guidelines for the OSCR elaborate that reporting of accidents and emergencies is specified under *Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995*. The operator is required to be compliant to these regulations but these are not contained within the safety case regulations.²¹⁹

Similarly, regulations concerning notification of emergencies are not contained in the safety case legislation (OSCR). In all cases where there is a non-permitted release of oil to the environment, the operator is required to inform the DECC or HM Coastguard and submit a report to the U.K. HSE under the provisions of the *Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005*.

²¹⁵ Ibid.

²¹⁶ The term ‘major accident’ is given to mean:

“(a) a fire, explosion or the release of a dangerous substance involving death or serious personal injury to persons on the installation or engaged in an activity on or in connection with it;

(b) any event involving major damage to the structure of the installation or plant affixed thereto or any loss in the stability of the installation;

(c) the collision of a helicopter with the installation;

(d) the failure of life support systems for diving operations in connection with the installation, the detachment of a diving bell used for such operations or the trapping of a diver in a diving bell or other subsea chamber used for such operations; or

(e) any other event arising from a work activity involving death or serious personal injury to five or more persons on the installation or engaged in an activity in connection with it.” (Government of the U.K., *The Offshore Installations (Safety Case) Regulations 2005*, Statutory Instrument 2005, No. 3117, Section 2, <http://www.legislation.gov.uk/uksi/2005/3117/made>.)

²¹⁷ Government of the U.K., *The Offshore Installations (Safety Case) Regulations 2005*, Section 12(c),(d).

²¹⁸ Ibid., Section 12(b).

²¹⁹ U.K. Health and Safety Executive, *A Guide to the Offshore Installations (Safety Case) Regulations 2005*, 2006, Schedule 9, <http://www.hse.gov.uk/pubns/priced/l30.pdf>.

Comparison to the Canadian Arctic Offshore

These regulations of reporting emergencies differ from in the Canadian Arctic offshore in that they are not contained within the safety case regulations, but rather under supporting regulations; otherwise there is little difference between the two.

3.6.4 Greenland

The March 2010 Exploration Drilling Guidelines specify that “any serious injury, loss of life, significant event or hazardous occurrence must be reported to the BMP immediately, . . . in accordance with the procedures established in the operator’s contingency plan.”²²⁰

It is also required that “those to whom duties have been assigned under [the] *Greenland Parliament Act* must, upon request, provide the Greenland Government, the emergency committee and the accident investigation board with all information they consider necessary for performing their activities [relating to the investigation].”²²¹ Also, additional requirements for reporting or notification of accidents or emergencies can be specified in a licence or an approval letter from the BMP.

Comparison to the Canadian Arctic Offshore

There are no specified requirements for internal reporting or review of incidents as there is in Canadian Arctic offshore, although offshore installations are required to follow international best practices.

3.6.5 Norway

In Norway, the operator has the responsibility to immediately alert the PSA by telephone²²² of hazards and accidents which “have led to or which might lead to severe and acute injury, acute life-threatening illness, severe impairment or loss of safety functions or other hazards that endanger the integrity of the facility and/or acute pollution release.”²²³

²²⁰ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, Section 3.4, http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf.

²²¹ Greenland Self Government, *Greenland Parliament Act of 7 December 2009 on Mineral Resources and Mineral Resource Activities (The Mineral Resources Act)*, Section 82(2), http://www.bmp.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf

²²² The Petroleum Safety Authority alerts the Norwegian Coast Directorate by telephone. The Petroleum Safety Authority forwards the written confirmation of the alert and the written report to the Coast Directorate, the Pollution Control Authority, the Norwegian Board of Health and other relevant authorities (Petroleum Safety Authority Norway, *Guidelines to Regulations Relation to Material and Information in the Petroleum Activities (The Information Duty Regulations)*, 2002, updated 2010, Section 11, http://www.ptil.no/getfile.php/Regelverket/Opplysningspliktforskriften_Veiledning-2010_e.pdf).

²²³ Ibid.

The operator must report damage to and incidents in connection with load bearing structures and pipeline systems to the PSA's Corrosion and Damage data base.²²⁴

Comparison to the Canadian Arctic Offshore

There is little difference between Norway's regulations and those in the Canadian Arctic offshore.

²²⁴ Petroleum Safety Authority Norway, *Regulations Relating to Health, Safety, and the Environment in the Petroleum Activities and at Certain Onshore Facilities (The Framework Regulations)*, 2010, Section 36, <http://www.ptil.no/framework-hse/category403.html> ; Petroleum Safety Authority Norway, *Information Duty Regulations*, Section 18.

3.7 Performance monitoring and compliance

3.7.1 Canadian Arctic Offshore

The *Canada Oil and Gas Drilling and Production Regulations* require that the management system contain provision for processes for conducting “periodic reviews or audits” of the management system and for “taking corrective actions” if the reviews or audits identify areas of improvement.²²⁵

The operator is responsible for submitting an annual safety report to the NEB. This report must include a summary of any incident or near-miss, including its root cause, causal factors and a discussion of efforts undertaken to improve safety.²²⁶

Incidents that must be reported to the NEB include:

- “a lost or restricted workday injury,
- death,
- fire or explosion,
- a loss of containment of any fluid from a well,
- an imminent threat to the safety of a person, installation or support craft, or
- a significant pollution event.”²²⁷

The operator of an installation must also submit to the NEB an annual environmental report that contains “a summary of environmental protection matters, including a summary of any incidents that may have an environmental impact, discharges that occurred and waste material that was produced, a discussion of efforts undertaken to reduce pollution and waste material, a description of environmental contingency plan exercises and a description of ice management activities.”²²⁸

3.7.2 United States

In the United States, “the lessee must designate specific management representatives who are responsible for reporting to management on the performance of the SEMS program.”²²⁹ The lessee must also annually review the SEMS program to determine if it “continues to be suitable, adequate and effective (by addressing the possible need for changes to policy, objectives, and other elements of the program in light of program audit results, changing circumstances and the

²²⁵ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 5(2)(i), <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

²²⁶ Ibid., Sections 75(2)(a) & 87.

²²⁷ Ibid., Section 75(2)(b).

²²⁸ Ibid., Section 86.

²²⁹ “What are management’s general responsibilities for the SEMS program?” U.S. Code of Federal Regulations Title 30, Pt. 250.1909(c).

commitment to continual improvement) and document the observations, conclusions and recommendations of that review.”²³⁰

In addition, the lessee must have their SEMS program “audited by either an independent third-party or your designated and qualified personnel within 2 years of the initial implementation of the SEMS program and at least once every 3 years thereafter.”²³¹ The audit must be a cover all thirteen elements in the SEMS program to evaluate compliance with the requirements placed on SEMS and to identify areas in which safety and environmental performance needs to be improved.²³² For a further discussion on the auditing and verification requirement see Chapter 7.

Within the regulations there is a provision that states that BOEMRE may evaluate or visit an installation to determine whether the lessee’s SEMS program is “in place, addresses all required elements, and is effective in protecting the safety and health of workers, the environment, and preventing incidents.”²³³ Specifically, BOEMRE evaluates aspects of the SEMS program, including “documentation of contractors, independent third parties, your designated and qualified personnel, and audit reports.”²³⁴

If BOEMRE determines that a lessee’s SEMS program is not in compliance with this subpart BOEMRE may initiate one or more of the following enforcement actions:

- “Issue an Incident(s) of Noncompliance;
- Assess civil penalties; or
- Initiate probationary or disqualification procedures from serving as an OCS operator.”²³⁵

Comparison to the Canadian Arctic Offshore

There is little difference between the U.S. and Canadian regulations.

3.7.3 United Kingdom

The *Offshore Installations (Safety Case) Regulations* require that the duty holder (Canadian Arctic: operator) must demonstrate that its safety case is “adequate to ensure he has established adequate arrangements for audits and for the making of reports thereof,”²³⁶ and that “all major accident risks have been evaluated and measures have been, or will be, taken to control those risks to ensure that the relevant statutory provisions will be complied with.”²³⁷

²³⁰ Ibid., Pt. 250.1909(d).

²³¹ “What are the auditing requirements for my SEMS program?,” U.S. Code of Federal Regulations Title 30, Pt. 250.1920.

²³² Ibid.

²³³ “How will BOEMRE determine if my SEMS program is effective?,” U.S. Code of Federal Regulations Title 30, Pt. 250.1924.

²³⁴ Ibid.

²³⁵ “What happens if BOEMRE finds shortcomings in my SEMS program?,” U.S. Code of Federal Regulations Title 30, Pt. 250.1927.

²³⁶ U.K. Health and Safety Executive, *A Guide to the Offshore Installations (Safety Case) Regulations 2005, 2006*, Section 12(1)(b), <http://www.hse.gov.uk/pubns/priced/l30.pdf>.

²³⁷ Ibid., Section 12(1)(d).

In this regulation, “audit” means “systematic assessment of the adequacy of the management system carried out by persons who are sufficiently independent of the system (but who may be employed by the duty holder) to ensure that such assessment is objective.”²³⁸

The *Safety Case Regulations* also require duty holders to undertake a periodic thorough review of accepted safety cases.²³⁹ The Guidelines clarify that “its purpose is to confirm that the safety case as a whole continues to be fundamentally sound.”²⁴⁰ The review must take place, at the latest, within five years of the safety case being accepted or from the last review, or when directed by HSE.²⁴¹

Comparison to the Canadian Arctic Offshore

There is little difference between these regulations in the U.K. and those in the Canadian Arctic offshore.

3.7.4 Greenland

Under the *Mineral Resources Act*, licensees have the responsibility to regularly submit reports on the activities performed and their results, according to the terms laid down in the issuing licences.²⁴² Beyond the regular requirements for monitoring, Section 86 of the Act stipulates that “the Greenland Government may issue orders or enforcement notices to ensure compliance [to the regulations] and licence terms.”²⁴³ To ensure compliance to regulation, the government’s “supervisory authority employees [shall] have at all times, on proof of identity and without a court order, access to all parts of enterprises and activities ... to the extent required for the purpose of carrying out the supervision.”²⁴⁴

Under Section 96 of the Act, the Greenland Government reserves the right to issue a fine on licensees who “intentionally or due to gross negligence misrepresent or misinform or fail to disclose information to which an authority is entitled under [the Act].”²⁴⁵

Beyond these requirements, there are no explicit stipulations concerning performance monitoring and compliance for HSE management systems in Greenland. Additional requirements for performance monitoring and compliance can be specified in a licence or an approval letter from the BMP.

²³⁸ Ibid., Section 12(3).

²³⁹ Ibid., Section 13 .

²⁴⁰ Ibid.

²⁴¹ Ibid.

²⁴² Greenland Self Government, *Greenland Parliament Act of 7 December 2009 on Mineral Resources and Mineral Resource Activities (The Mineral Resources Act)*, 2009, Section 86(4), http://www.bmp.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf.

²⁴³ Ibid., Section 86(2).

²⁴⁴ Ibid.

²⁴⁵ Ibid., Section 96(2)(ii).

Comparison to the Canadian Arctic Offshore

Similar to the National Energy Board's requirement for the operator to submit an annual report, Greenland requires licensees to 'regularly' submit reports. As in Canadian Arctic offshore, the government has the right to inspect installations. Dissimilar to Canadian Arctic offshore, there are no audit requirements, though a condition for auditing could be required as part of a project licence.

3.7.5 Norway

In Norway, it is required that the management system includes procedures to improve HSE in all phases and activities to reducing risk.²⁴⁶ This is achieved through regulations that require the party responsible to ensure that data is collected and used to monitor and control technical, operational and organizational aspects in order to ensure regulatory compliance and improvement in HSE performance and to monitor trends in the level of risk.²⁴⁷ This requirement extends to the operator to ensure that all contractors' management of HSE meets regulation and any "necessary adjustments are made with respect to its own and other participants' management systems, to ensure the necessary uniformity."²⁴⁸

Performance monitoring of management systems include management system audits, inspections and measurements for every part of the management system.²⁴⁹ For example, the requirement for a management system to account for the minimum number of personnel required and their competency level to complete activities that have potential consequences for HSE must be regularly reviewed. Where corrective and preventive actions, including improvement of systems and equipment, are identified, there is a requirement to implement them.²⁵⁰

Comparison to the Canadian Arctic Offshore

Norway requires that management system must be regularly reviewed, but unlike Canadian Arctic offshore, does not specify the frequency or responsible body. Unlike Canadian Arctic offshore, there are no provisions in Norway that allow the regulator to visit and inspect and installation. Similar to Canadian Arctic offshore, management systems must be periodically audited.

²⁴⁶ Petroleum Safety Authority Norway, *Regulations Relating to Health, Safety, and the Environment in the Petroleum Activities and at Certain Onshore Facilities (The Framework Regulations)*, 2010, Section 15, <http://www.ptil.no/framework-hse/category403.html>.

²⁴⁷ Petroleum Safety Authority Norway, *Regulations Relating to Management and the Duty to Provide Information in the Petroleum Activities and at Certain Onshore Facilities (The Management Regulations)*, 2010, Section 10, <http://www.ptil.no/management/category401.html>.

²⁴⁸ Petroleum Safety Authority Norway, *Framework Regulations*, Section 18.

²⁴⁹ Ibid., Section 19.

²⁵⁰ Petroleum Safety Authority Norway, *Management Regulations*, Section 22.

4. Drilling and Well Activities

This chapter examines the drilling and well activities requirements for Arctic offshore drilling operations in Canada, and offshore drilling operations in the U.S., the U.K., Greenland, and Norway. Legislation and regulations relating to drilling and well activities fall under these categories: well design; marine risers and riser margins; casing and cementing requirements; and well test requirements. A comparison of these requirements among all jurisdictions is made in Table 5 (below).

Well design

The well should be designed to ensure the integrity of the well, the safety and health of persons and prevent the uncontrolled release of fluids, from drilling to completion to abandonment. Well design regulations specify the safety, equipment and testing requirements that an operator must plan for before drilling the well. Most of the well design regulations require the operator to consider, among others, pore pressure, drilling fluids weights, casing setting depths and geological formations.

The regulations for well design may be required as part of an operator's application for permit to drill, exploration plan or another plan that must be submitted and approved by the regulator prior to beginning activities.

Marine Risers and Riser Margins

A marine riser is a large-diameter pipe used by floating drilling units to connect the subsea blowout preventer to the surface rig. It returns mud to the surface. The riser is also a temporary extension of the wellbore to the surface. The marine riser houses the drill bit and drill string and must be flexible to deal with movement of the surface drilling unit.

A riser margin is the difference in hydrostatic pressure in the riser mud column and the surrounding sea water. In the case of a riser leak or disconnection, the riser margin will be maintained if there is sufficient hydrostatic pressure from the remaining drilling fluid. This is necessary in order to maintain well control and prevent a severe kick and hole collapse.

Casing and Cementing

Well casing is a steel pipe placed in a well during drilling which lines the well to prevent it from caving in, to prevent any escape of fluids, and to allow the extraction of petroleum during well production. The casing must be designed to withstand a number of forces and stressors as demonstrated through quality parameters such as collapse resistance, burst pressure and tensile load.

Casing string is the entire length of all the joints of casing in the well. The hole drilled for the casing string must be wide enough to fit the casing, allowing room for cement between the casing and wall of the hole (also called borehole).

Cementing provides strength to the borehole and helps to isolate dangerous high-pressure zones from the well. Cementing also protects the casing from corrosion from formation fluids. Cementing is performed by inserting a pipe that injects a cement slurry (made of water, cement and other additives) inside the well casing so that the cement slurry is pushed out into the annulus (the void between the casing and the borehole) and fills it, starting from the bottom, to a desired depth. Some regulations specify the wait time between cementing and resuming operations, so that the cement has time to harden sufficiently.

There are a number of different casing and cementing intervals used in well drilling and production:

- Conductor casing – this casing is installed and cemented into place before drilling begins. It serves as support during drilling to prevent the well from caving in.
- Surface casing – the casing closest the surface that must protect water zones during drilling and operations.
- Intermediate casing – this casing is optional and usually the longest section of casing in the well. It is used to protect the well from underground pressure zones or contaminants that can affect the well. It can be cemented into place. There may be several intermediate casing strings.
- Production casing – the smallest casing that is installed last extends to the surface or the previous set of casing.

Production tubing is often used inside the last casing and is the pipe through which the petroleum fluids will flow during production.

Well testing

Well testing is conducted in order to determine the potential of the well to yield hydrocarbons. It involves gathering pressure data and fluid samples from a formation. It is also called a formation test or formation flow test.

Table 5: Comparison of drilling and well activity regulations by jurisdiction to Canadian Arctic Offshore

Regulatory Topic	Canadian Arctic Offshore	United States	United Kingdom	Greenland	Norway
1. Well design	Wells must be designed to ensure safety and prevent waste and incidents, and components of the well must be operated in accordance with good engineering practice.	A number of plans must be submitted for approval to the regulator with details on the well design criteria, casing and cementing activities, procedures for drilling the well and operator's plans to drill a relief well if needed.	The regulations require the operator to ensure the integrity of the well from design to abandonment. The well must be designed to prevent fluid escape, so that health and safety risk are kept as low as reasonably practicable.	There are no regulations pertaining to well design, although such requirements could be included in a licence or an approval letter. Under the March 2010 Exploration Drilling Guidelines, as part of an Approval to Drill Application, an operator must submit a detailed drilling program and site survey plan.	The operator to submit a well program that described the activities to be carried out and the equipment to be used. No specific requirements are given the on well design itself. The operator is encouraged to use a risk assessment to minimize risk to people and of pollution and to calculate the probability of failure.
3. Marine riser and riser margins	A marine riser must be designed to fulfill a number of conditions including: access to the well, isolate the well bore from the sea, withstand physical forces and motion of the drilling platform, and allow the drill fluid to be returned to the surface.	There are no specific regulations pertaining to marine risers or riser margin in the regulations. The operator must inspect the marine riser once a day to ensure it is functioning properly.	Marine risers are included in <i>Pipelines Safety Regulations</i> . An emergency shutdown valve is required to test and maintain the riser. Riser margins are not mentioned. Guidance is provided to operators on safety instruments systems to protect risers from over-pressure causing leaks and riser failure.	No regulations pertaining to marine riser or riser margins, although such requirements could be included in a licence or an approval letter	No specific requirements for marine riser and riser margins. The NORSOK standard is recommended which indicates that riser margin be maintained to ensure proper hydrostatic pressure between the riser and the surrounding seawater. In the case of a riser disconnect, a number of risk-reducing measures are suggested, the primary of which is maintaining the riser margin.

Drilling and Well Activities

<p>4. Casing and cementing</p>	<p>Casing and cementing design and installation must meet certain goals of safety and protection of surrounding zones, and be able to withstand downhole pressure and other forces and stressors.</p>	<p>The requirements are prescriptive and detailed for casing and cementing program design and installation. The operator must meet a number of conditions including preventing the release of fluids, controlling pressures, and preventing movement between surrounding environment and hydrocarbon zones.</p>	<p>No specific requirements for well casing and cementing. The materials used in casing and cementing must meet industry standards.</p>	<p>The guidelines specify that the operator must provide details on the casing program, including the weight and grade of casing, casing depth, the cementing program, demonstration of the sufficiency of the casing string design based on pressure, cement height and mud density, procedure for testing the casing strength prior to drilling, and more.</p>	<p>No specific requirements for well casing or cementing. Instead operators must meet overall well barrier principles.</p>
<p>5. Well test requirements</p>	<p>A formation flow test must be approved by the regulator and must be conducted to obtain data on the productivity of the well, characteristics of the reservoir and sample of formation fluids. The well test must “be conducted safely, without pollution and in accordance with good oilfield practices.”</p>	<p>The operator must submit well test plans with the Application for Permit to Drill or Application for Permit to Modify. The plans must include descriptions of estimated tubing pressures and flow rates, descriptions of the equipment, including safety equipment, methods for handling fluids, and the planned test procedures. There are no references to the safety or pollution conditions of the well test, as in NEB regulations.</p>	<p>No particular requirements for well production testing. Well testing procedures and plans would need to be submitted to the regulator as part of the operator’s safety case.</p>	<p>No specific regulations for well production test requirements currently exist, although such requirements could be included in a licence or an approval letter. The March 2010 Exploration Drilling Guidelines specify well test safety precautions to prevent escape of fluids, drilling rig preparation for operation before production testing, well perforation operation and safety requirements for the use of other equipment that might be a hazard in connection with the use of explosives.</p>	<p>No specific requirements for well production testing. The <i>PSA Facilities Regulations</i> Section 48 require that all well barriers shall be designed to ensure well integrity over its lifetime, to prevent movement of fluids to the external environment and tested to verify their performance. NORSOK D-010 standard is recommended which suggests well testing activities to verify well integrity and well control action procedures should incidents occur.</p>

4.1 Well design

4.1.1 Canadian Arctic Offshore

The NEB's regulations for well design in the Canadian Arctic are performance-based, requiring the operator to meet certain conditions for safety and prevention of waste.

The well design must be reflected in the safety plan and environmental protection plan, submitted by the operator as part of their application for authorization. This includes the studies and risk evaluations conducted to identify and manage hazards and safety risks.²⁵¹

There are a number of elements to well design. In Part 4 of the *Canada Oil and Gas Drilling and Production Regulations*, well design regulations include the following elements: drilling fluid systems, marine riser, drilling practices, directional and deviation surveys, formation leak-off test, formation flow test, well control and casing and cementing.²⁵² Some of these elements are covered here and some (well testing, marine riser, drilling fluid system, well control, casing and cementing) elements are covered later in this report.

Section 25 of the *Canada Oil and Gas Drilling and Production Regulations* specify that the operator shall ensure that “(a) all wells, installations, equipment and facilities are designed, constructed, tested, maintained and operated to prevent incidents and waste under the maximum load conditions that may be reasonably anticipated during any operation.”²⁵³ An inspection of an installation and equipment is to be completed every five years to ensure safe operations.²⁵⁴

Section 26 of the *Canada Oil and Gas Drilling and Production Regulations* specify “(a) the components of an installation and well tubulars, Christmas trees and wellheads are operated in accordance with good engineering practices; and (b) any part of an installation that may be exposed to a sour environment is designed, constructed and maintained to operate safely in that environment.”²⁵⁵

Section 30 of the *Canada Oil and Gas Drilling and Production Regulations* requires that the operator ensures the safe, controlled drilling operations and prevention of pollution by ensuring “adequate equipment, procedures and personnel are in place...”²⁵⁶

Requirement for well design in terms of casing and cementing are included in Section 39 of the *Canada Oil and Gas Drilling and Production Regulations* and summarized below in 4.3.1.

²⁵¹ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 6c, 8 and 9, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

²⁵² Ibid., Section 25, 26, 28, 29, 31, 31, 33, 34, 35, 36, 37, 38.

²⁵³ Ibid., Section 25,a.

²⁵⁴ Ibid., Section 25,b.

²⁵⁵ Ibid., Section 26.

²⁵⁶ Ibid., Section 30.

Regulations on production tubing design in a well is included in Section 44. It must be designed to withstand maximum forces and stresses and to allow maximum recovery of hydrocarbons.²⁵⁷

Well completion regulations are included in Section 46. The operator must ensure that the well is completed safely and “allows for maximum recovery.”²⁵⁸ The regulations describe the conditions for to ensure this occurs during completion of the well.

Section 47 and 48 describe the regulations for subsurface safety valve and wellhead and Christmas tree equipment, which are further described in this report in 6.1.1.

4.1.2 United States

The regulations in the United States on well design are prescriptive in nature. The regulation 30 CFR 250.201 describes the plans that must be submitted to and approved by BOEMRE before any drilling or well activities commence. These plans include an Application for Permit to Drill (APD) and an Exploration Plan (EP), which include some requirements for well design.²⁵⁹

The regulations 30 CFR 250.411–250.418 specify that in addition to APD forms, the operator must submit additional information on the location of the well, design criteria for the well, drilling prognosis, casing and cementing activities, diverter and BOP system descriptions, requirements for using an MODU and more.²⁶⁰

As per 30 CFR 250.413, the description of well drilling design criteria must address:

- “(a) Pore pressures;
- (b) Formation fracture gradients, adjusted for water depth;
- (c) Potential lost circulation zones;
- (d) Drilling fluid weights;
- (e) Casing setting depths;
- (f) Maximum anticipated surface pressures.
- (g) A single plot containing estimated pore pressures, formation fracture gradients, proposed drilling fluid weights, and casing setting depths in true vertical measurements;
- (h) A summary report of the shallow hazards site survey that describes the geological and manmade conditions if not previously submitted; and
- (i) Permafrost zones, if applicable.”²⁶¹

The drilling prognosis 30 CFR 250.415 includes procedures for drilling the well.

General information that must accompany the EP are specified in 30 CFR 250.213. These include the availability of a rig to drill a relief well, the financial capability to do so and the estimated time it would take to do so.²⁶²

²⁵⁷ Ibid., Section 44.

²⁵⁸ Ibid. Section 46.

²⁵⁹ “What plans and information must I submit before I conduct any activities on my lease or unit?” U.S. Code of Federal Regulations Title 30, Pt. 250.201

²⁶⁰ “What information must I submit with my application?” U.S. Code of Federal Regulations Title 30, Pt. 250.411.

²⁶¹ “What must my description of well drilling design criteria address?” U.S. Code of Federal Regulations Title 30, Pt. 250.413.

The casing and cementing programs must include a number of components, as stated in 30 CFR 250.415, such as casing design safety factors, type of cement and setting depth, which is considered in more detail below in section 4.3.2 of this report.²⁶³

Notice to Lessees and Operator (NTL) 2009-G21 identifies standard conditions that regulators will place on approvals of all applications to drill and complete wells, and other well activities. NTLs provide guidance on interpreting and complying with the regulations but operators may use other approaches provided they receive BOEMRE approval.²⁶⁴

Comparison to the Canadian Arctic Offshore

In comparison to Canadian Arctic offshore, the regulations in the U.S. are more prescriptive, specifying what detailed information must be submitted on well design.

4.1.3 United Kingdom

The U.K.'s regulations for well design are performance-based and require the operator to minimize risk to 'as low as is reasonably practicable.'

The U.K.'s Offshore Installations and Wells (1996), Part IV, regulation 13 describes the well design requirements. The regulations require the operator to ensure the integrity of the well from design to abandonment.²⁶⁵ Specifically, the well must be designed so that:

“(a) so far as is reasonably practicable, there can be no unplanned escape of fluids from the well; and

(b) risks to the health and safety of persons from it or anything in it, or in strata to which it is connected, are as low as is reasonably practicable”²⁶⁶

The well operator is required to assess the subsurface conditions before designing the well. Regulation 14 includes requirements for the well operator to assess the geological strata and formations and associated hazards prior to designing the well and to continue to monitor these conditions to ensure that the performance-based requirements in regulation 13 are fulfilled.²⁶⁷

²⁶² “What general information must accompany the EP?,” U.S. Code of Federal Regulations Title 30, Pt. 250.213.

²⁶³ “What must my casing and cementing programs include?,” U.S. Code of Federal Regulations Title 30, Pt. 250.415.

²⁶⁴ U.S. Bureau of Ocean Energy Management, Regulation and Enforcement, *Notice to Lessees: Standard Conditions for Approval of Well Activities*, NTL No. 2009-G21, <http://www.gomr.boemre.gov/homepg/regulate/regs/ntls/2009NTLs/09-g21.pdf>.

²⁶⁵ U.K. Health and Safety Executive, *The Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996*, <http://www.legislation.gov.uk/ukxi/1996/913/part/IV/made>.

²⁶⁶ Ibid., Regulation 13(1).

²⁶⁷ Ibid., Regulation 14(1-3).

Regulation 15 requires that safety and integrity are considered through the design and construction of the well. The well must be designed and constructed so that it can be suspended or abandoned in a safe manner and that there is no escape of fluids.²⁶⁸

Regulation 16 requires that the materials used to construct the well ensure that the performance-based requirements in regulation 13 are fulfilled.²⁶⁹

Regulation 18 requires that before adopting the final design for the well, the operator must make arrangements for an independent and competent person to examine that the well is designed and will be operated according to the performance-based requirements described in Section 13 (a, b).²⁷⁰

A guide to the well aspects of the *Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996* was produced by HSE to help with interpretation of the regulations.²⁷¹

The *Offshore Installations (Safety Case) Regulations 2005* specify details on well operations that must be submitted as part of the safety case. In Schedule 2, Section 8, particulars of a plant and arrangements for control of operations on a well must be included in the safety case to specify how the pressure in the well will be controlled, how the release of hazardous substances will be prevented and how drilling equipment will not damage subsea equipment.²⁷²

A guide to the *Offshore Installations (Safety Case) Regulations 2005* was produced by HSE to help with interpretation of the regulations.²⁷³

Comparison to the Canadian Arctic Offshore

Regulations in the U.K. and the Canadian Arctic offshore are similar in their requirements that the operator must prove that the well has been designed to meet performance-based conditions for safety and prevention of fluid release.

4.1.4 Greenland

The *Mineral Resources Act* aims broadly “to ensure that activities under the Act are performed in a sound manner as regards safety, health, the environment, resource exploitation and social sustainability and appropriately and according to acknowledged best international practices

²⁶⁸ Ibid., Regulation 15.

²⁶⁹ Ibid., Regulation 16.

²⁷⁰ Ibid., Regulation 18.

²⁷¹ Ibid.

²⁷² Government of the U.K., *The Offshore Installations (Safety Case) Regulations 2005*, Statutory Instrument 2005, No. 3117, Schedule 2, Section 8, <http://www.legislation.gov.uk/ukxi/2005/3117/made>.

²⁷³ U.K. Health and Safety Executive, *A Guide to the Offshore Installations (Safety Case) Regulations 2005*, 2006, <http://www.hse.gov.uk/pubns/priced/130.pdf>.

under similar conditions.”²⁷⁴ Greenland’s Exploration Drilling Guidelines help to interpret the legislation and provide the minimum requirements for operators.²⁷⁵

The guidelines state that operators are required to submit a detailed drilling program and site survey plan to obtain an Approval to Drill from the BMP before beginning any well activities.²⁷⁶ Additional requirements for well design can be specified in a licence or an approval letter from the BMP.

Comparison to the Canadian Arctic Offshore

Greenland does not have the performance-based requirements for well design that Canada’s National Energy Board does. While the regulator may include additional requirements in the permit for an Approval to Drill, these requirements are not explicit in the regulations.

4.1.5 Norway

In Norway the operator is required to show compliance with safety conditions and is given the option to use probabilistic calculations to prove it is in control of the well through well design. The *Activities Regulations*, Section 81 requires the operator to submit a well program that describes the activities to be carried out and the equipment to be used.²⁷⁷ No specific requirements are given on the well design itself. The PSA, in its Guidelines Regarding the *Activities Regulations*, which are intended to help with interpretation of the regulations, has recommended that the NORSOK D-010 standard “should be used in the area of health, working environment and safety.”²⁷⁸ 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.²⁷⁹

Section 85 of the *Activities Regulations* requires tested well barriers and in the case of a barrier fail, no other activities shall be carried out than to restore the barrier.²⁸⁰ In the guidelines for this regulation, the NORSOK D-010 standard is recommended.²⁸¹ The NORSOK D-010 standard advises that design basis, premises, assumptions and load case scenarios for the well be established. It also specifies that:

²⁷⁴ Greenland Self Government, *Greenland Parliament Act of 7 December 2009 on Mineral Resources and Mineral Resource Activities (The Mineral Resources Act)*,

http://www.bmp.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf

²⁷⁵ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010.

http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf; Pers. Comm., Maja Sofie Burggaard, Special Advisor, Licence Department; Petroleum Section, Bureau of Minerals and Petroleum, Greenland Self-Government, May 5, 2011.

²⁷⁶ Ibid.

²⁷⁷ Petroleum Safety Authority Norway, *Regulations Relating to Conducting Petroleum Activities (The Activities Regulations)*, http://www.ptil.no/getfile.php/Regelverket/Aktivitetsforskriften_e.pdf

²⁷⁸ Petroleum Safety Authority Norway, *Guidelines Regarding the Activities Regulations*, <http://www.ptil.no/activities/category404.html>

²⁷⁹ Standards Norway, *NORSOK Standard D-010: Well Integrity in Drilling and Well Operations*, 2004, <http://www.standard.no/PageFiles/1315/D-010r3.pdf>

²⁸⁰ Petroleum Safety Authority Norway, *Activities Regulations*, Section 85.

²⁸¹ Petroleum Safety Authority Norway, *Guidelines Regarding the Activities Regulations*.

“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 $10^{-3,5}$.²⁸²

In Section 10 of the *Facilities Regulations*, all installations, systems and equipment must be designed to limit human error, without risk to personnel and of pollution, and be “suitable for use and able to withstand the loads they can be exposed to during operations.”²⁸³

Comparison to the Canadian Arctic Offshore

Norway’s regulations include performance-based conditions for well design as in the Canadian Arctic offshore. In Norway, the operator is encouraged to use a risk assessment approach as defined by NORSOK D-010 standard to minimize risk to people and of pollution and to calculate the probability of failure.

²⁸² Standards Norway, *NORSOK Standard D-010: Well Integrity in Drilling and Well Operations*, Section 4.3.4.

²⁸³ Petroleum Safety Authority Norway, *Regulations Relating to Design and Outfitting of Facilities, etc. in the Petroleum Activities (The Facilities Regulations)*, <http://www.ptil.no/facilities/category400.html>

4.2 Marine riser and riser margins

4.2.1 Canadian Arctic Offshore

The regulations in the Canadian Arctic offshore require that the marine riser meet a number of performance conditions. In Section 29 *Canada Oil and Gas Drilling and Production Regulations*, the marine riser must be capable of:

- “(a) furnishing access to the well;
 - (b) isolating the well-bore from the sea;
 - (c) withstanding the differential pressure of the drilling fluid relative to the sea;
 - (d) withstanding the physical forces anticipated in the drilling program; and
 - (e) permitting the drilling fluid to be returned to the installation.
- (2) The operator shall ensure that every marine riser is supported in a manner that effectively compensates for the forces caused by the motion of the installation.”²⁸⁴

There is no direct reference to riser margins in the regulations.

4.2.2 United States

There are no specific regulations pertaining to marine risers or riser margin in the regulations. However, 30 CFR 250.800(b)(2) requires all new floating production systems to meet API RP 2RD in terms of drilling and production riser standards.²⁸⁵ This American Petroleum Institute publication provides guidance on the structural design of risers and is available for purchase.

30 CFR 250.516 requires the operator to inspect the marine riser once a day to ensure it is functioning properly.²⁸⁶

The term riser margin is not used in U.S. regulations.

Comparison to the Canadian Arctic Offshore

The U.S. does not have performance-based requirements for marine risers as in the Canadian Arctic offshore but does require use industry best practices in this area. An inspection of the marine riser once a day is required in the U.S. which is not specified in the Canadian regulations.

²⁸⁴ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 29, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

²⁸⁵ “API RP 2RD: Design of risers for Floating Production Systems (FPSs) and Tension-Leg Platforms (TLPs),” American Petroleum Institute, 1998; “General requirements,” U.S. Code of Federal Regulations Title 30, Pt. 250.800.

²⁸⁶ “Blowout preventer system tests, inspections, and maintenance,” U.S. Code of Federal Regulations Title 30, Pt. 250.516.

4.2.3 United Kingdom

There is no mention of marine risers or riser margins in the U.K.'s Offshore Installations and Wells (1996) regulations.

Instead, risers are mentioned in the *Pipelines Safety Regulations* and included in the definition of a pipeline, which is defined as “ a valve, valve chamber or similar work shall be deemed to be annexed to, or incorporated in the course of, a pipe or system where it connects the pipe or system to plant, an offshore installation, or a well.”²⁸⁷ An emergency shutdown valve is required to be fitted to all risers of a pipeline as low as is reasonably practicable and so that it can be safely inspected, maintained and tested.²⁸⁸

HSE has produced a guidance document to be used by regulators when assessing operator's safety cases and the inspection of pipeline riser systems.²⁸⁹ The document addresses safety instruments systems to protect risers from overpressure causing leaks and riser fails.

Comparison to the Canadian Arctic Offshore

The U.K. does not have performance-based requirements for risers as in the Canadian Arctic offshore. Still, like in the Canadian Arctic offshore, the operator would be required to show how the riser will withstand pressure and other forces that could cause leaks and other damage.

4.2.4 Greenland

No specific regulations relating to marine riser or riser margins currently exist. Although offshore installations are required to follow best international practices and additional requirements for well design can be specified in a licence or an approval letter from the BMP.

Comparison to the Canadian Arctic Offshore

The absence of marine riser regulations in Greenland are in contrast to Canada's National Energy Board performance-based regulations on marine risers. Both jurisdictions have no direct mention of riser margins in their regulations.

4.2.5 Norway

In Norway an important principle in the regulations is the concept of well barriers and control of well barriers. The term well barrier includes the fluid column in the marine riser. Section 85 of the *Activities Regulations* requires tested well barriers and in the case of a barrier fail, no other activities shall be carried out than to restore the barrier.²⁹⁰

²⁸⁷ U.K. Health and Safety Executive, *The Pipelines Safety Regulations 1996*, <http://www.legislation.gov.uk/ukxi/1996/825/contents/made>, Section 3 (3).

²⁸⁸ Ibid., Section 19.

²⁸⁹ U.K. Health and Safety Executive, “Safety instrumented systems for the overpressure pipeline protection of pipeline risers,” <http://www.hse.gov.uk/foi/internalops/hid/spc/spectosd31.htm>

²⁹⁰ Petroleum Safety Authority Norway, *Regulations Relating to Conducting Petroleum Activities (The Activities Regulations)*, <http://www.ptil.no/activities/category399.html>.

In the guidelines for Section 85, the NORSOK D-010 standard is recommended.²⁹¹ NORSOK D-010 standard Section 15.1 states “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).”²⁹² The standard includes requirements for riser equipment²⁹³ and in the case of planned or accidental disconnect of the marine riser, alternative risk reducing measures are provided.²⁹⁴ Maintaining the riser margin is the primary recommended compensating measure but other risk reducing measures are suggested such as use of weighted fluid, installation of a bridge plug or use two shear/seal rams.²⁹⁵

Comparison to the Canadian Arctic Offshore

In Norway, the operator must show how the marine riser fulfills an overall well barrier principle. These principles are similar to the performance-based requirements for marine risers in the Canadian Arctic offshore. The concept of riser margin is used only in Norway.

²⁹¹ Petroleum Safety Authority Norway, *Guidelines Regarding the Activities Regulations*, Section 81, <http://www.ptil.no/activities/category404.html>

²⁹² Standards Norway, *NORSOK Standard D-010: Well Integrity in Drilling and Well Operations*, 2004, <http://www.standard.no/PageFiles/1315/D-010r3.pdf>, Section 15.1.

²⁹³ *Ibid.*, Section 4.2.5.3.

²⁹⁴ *Ibid.*, Table 1, Section 5.4.2.

²⁹⁵ *Ibid.*

4.3 Casing and cementing

4.3.1 Canadian Arctic Offshore

The regulations for well casing and cementing in the Canadian Arctic offshore are performance-based, requiring the operator to meet certain conditions for safety, prevention of waste and protection of formation zones. Sections 39-43 of the *Canada Oil and Gas Drilling and Production Regulations* specify well casing and cementing design and installation requirements. The well and casing must be designed so that

- “(a) the well can be drilled safely, the targeted formations evaluated and waste prevented;
- (b) the anticipated conditions, forces and stresses that may be placed upon them are withstood; and
- (c) the integrity of gas hydrate and permafrost zones — and, in the case of an onshore well, potable water zones — is protected.”²⁹⁶

In addition, without specifying the depth of the casing as in other jurisdictions, the regulations indicate that the well and casing must be designed to withstand forces and stresses, and to achieve a safe bottom hole pressure.²⁹⁷ The cement slurry must be designed and installed to support the casing and to prevent the corrosion of the casing, so that formation fluids do not move in the casing annuli and so that oil, gas water, gas hydrate and permafrost zones are isolated and their integrity is maintained.²⁹⁸

After cementing, the operator is required to wait until the cement has “reached the minimum compressive strength sufficient to support the casing and provide zonal isolation”²⁹⁹ after cementing of the casing or casing liner. The casing must be pressure-tested to ensure its integrity under maximum anticipated operating pressure.³⁰⁰

4.3.2 United States

The regulations for well casing and cementing in the United States are a combination of performance-based and prescriptive requirements.

Regulations 30 CFR 250.420 and 30 CFR 250.415 provide the requirements for casing and cementing programs.

Casing and cementing requirements are found in 30 CFR 250.420–250.423. All wells must be cased and cemented to properly control pressures and fluids, prevent the release of fluids,

²⁹⁶ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 39, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

²⁹⁷ Ibid., Section 40.

²⁹⁸ Ibid., Section 41.

²⁹⁹ Ibid., Section 42.

³⁰⁰ Ibid., Section 43.

prevent movement between hydrocarbon strata, protect freshwater aquifers, and support unconsolidated sediments.³⁰¹ The casing program must be signed by a Registered Professional Engineer verifying that there will be at least two independent barriers.³⁰² The casing must meet a number of requirements such as installing dual mechanical barriers in addition to cement, and the cement placed below about 150 m (500 ft) must be able to withstand a minimum compressive strength of about 3,500 kPa (500 psi) before drilling out the casing or commencing operations.³⁰³

Requirements for the design, setting and cementing of casing strings and liners by type of casing string are provided in 30 CFR 250.421.³⁰⁴ The required wait time after cementing surface, intermediate or production casing before resuming drilling is 12 hours minimum.³⁰⁵ For conductor casing, drilling can be resumed in 8 hours.³⁰⁶ Requirements to pressure test the casing, depending upon the type of casing string, are provided in 30 CFR 250.423.³⁰⁷

The casing and cementing program must be submitted with the Application for Permit to Drill. 30 CFR 250.415 requires that the program includes hole sizes and casing sizes, casing safety design factors, type and amount of cement and permafrost protection.³⁰⁸ For wells drilled in areas with a water depth greater than about 150 m (500 ft) with shallow water flow potential or other hazards, the operator must include a statement about how they evaluated these areas according to the best practices in API 65 “Recommended Practice for Cementing Shallow Water Flow Zones in Deep Water Wells.”³⁰⁹

In addition the operator must describe how they evaluated best practices in API RP 65 Part 2 “Isolating Potential Flow Zones During Well Construction” and describe the mechanical barriers and cementing practices that will be used for each casing string.³¹⁰

The interim final rule requires additional safety measures as of October 2010. The rule “Oil and Gas and Sulphur Operations in the Outer Continental Shelf—Increased Safety Measures for Energy Development on the Outer Continental Shelf” includes a number of recommendations pertaining to regulations 30 CFR 250.415 (f), 250.420 and 250.423.³¹¹

³⁰¹ “What well casing and cementing requirements must I meet?,” U.S. Code of Federal Regulations Title 30, Pt. 250.420.

³⁰² Ibid.

³⁰³ Ibid.

³⁰⁴ “What are the casing and cementing requirements by type of casing string?,” U.S. Code of Federal Regulations Title 30, Pt. 250.421.

³⁰⁵ “When may I resume drilling after cementing?,” U.S. Code of Federal Regulations Title 30, Pt. 250.422.

³⁰⁶ Ibid.

³⁰⁷ “What are the requirements for pressure testing casing?,” U.S. Code of Federal Regulations Title 30, Pt. 250.423.

³⁰⁸ “What must my casing and cementing programs include?,” U.S. Code of Federal Regulations Title 30, Pt. 250.415.

³⁰⁹ Ibid.

³¹⁰ Ibid.

³¹¹ U.S. National Archives and Records Administration, “Oil and Gas and Sulphur Operations in the Outer Continental Shelf—Increased Safety Measures for Energy Development on the Outer Continental Shelf; Final Rule,” *Federal Register* 75, no. 198 (October 14, 2010): 63346, <http://edocket.access.gpo.gov/2010/pdf/2010-25256.pdf>

Comparison to the Canadian Arctic Offshore

Although the regulations in the U.S. for casing and cementing are meant to meet a number of safety conditions as in the Canadian Arctic offshore, the U.S. regulations includes more prescriptive details such as cementing wait times, pressure testing and regulations by casing string type, and the requirement for the operator to show how they evaluated and incorporated industry best practices.

4.3.3 United Kingdom

The only reference to well casing and cementing is in Regulation 16 of *Offshore Installations and Wells (1996)*, Part IV, which requires that the materials used to construct the well must conform to industry standards, including well casings and cement.³¹²

However, other than referring to adherence to other standards, there are no specific requirements for well casing and cementing in U.K. regulations.

Comparison to the Canadian Arctic Offshore

The U.K. has few specific requirements for casing and cementing. Even though the U.K. usually has performance-based requirements as in the Canadian Arctic offshore, it does not include specific conditions that the operator must meet in terms of casing and cementing.

4.3.4 Greenland

According to the March 2010 Exploration Drilling Guidelines the operator must provide details on the casing program including the weight and grade of casing, casing depth, the cementing program, demonstration of the sufficiency of the casing string design based on pressure, cement height and mud density and procedure for testing the casing strength prior to drilling and as part of the detailed drilling program submitted as part of the Approval to Drill Application.³¹³

In addition, the guidelines specify further requirements for casing installation depending upon the type of casing (conductor, surface, intermediate, production). The casing shoes must allow complete control of the well at all times.³¹⁴ A liner must be cemented over its full length to isolate hydrocarbon or high pressure zones.³¹⁵ The guidelines indicate that casing strings must be designed to withstand “any mechanical and chemical influence which may be expected during drilling, testing and stimulation” and be pressure tested.³¹⁶

³¹² U.K. Health and Safety Executive, *The Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996*, <http://www.legislation.gov.uk/ukxi/1996/913/part/IV/made>, Regulation 16.

³¹³ Greenland Bureau of Minerals and Petroleum. *Exploration Drilling Guidelines*, 2010. http://www.bmp.gl/images/stories/petroleum/bmp_Exploration_Drilling_Guidelines_March_2010.pdf, Section 4.10.

³¹⁴ Ibid., Section 5.2.

³¹⁵ Ibid., Section 5.2,(e).

³¹⁶ Ibid., Section 5.4-5.5.

Furthermore, additional requirements for casing and cementing activities can be specified in a licence or an approval letter from the BMP.

Comparison to the Canadian Arctic Offshore

In Greenland, the operator must provide the regulator with a description of their casing and cementing program through the Approval to Drill Application, but unlike in the regulations for the Canadian Arctic offshore, few performance-based conditions are mentioned. The one exception is that like the regulations for the Canadian Arctic offshore, the casing must be designed to withstand forces and stresses, to achieve a safe bottom hole pressure.

4.3.5 Norway

In Norway the regulations provide overall requirements for casing and cementing based on the well barrier principle. The PSA *Facilities Regulations* Section 48 require that all well barriers be designed to ensure well integrity over its lifetime and to prevent movement of fluids to the external environment and be tested to verify their performance.³¹⁷ Requirements for the design of the cementing unit are provided in Section 52.³¹⁸

In the guidelines for this regulation, the NORSOK D-010 standard is recommended.³¹⁹ The standard lists the requirements for designing, verifying and monitoring casing, cement and cement plugs.³²⁰ The casing must be pressure tested to withstand maximum anticipated differential pressure over the lifetime of the well.³²¹ The casing annulus must be cemented 100m above the casing shoe. The cement must be verified through a formation strength test.³²² Cement plugs must be designed for the highest temperature differential pressure and highest downhole temperature.³²³

Comparison to the Canadian Arctic Offshore

Like the regulations for the Canadian Arctic offshore, Norway requires the operator to design its casing and cementing program to meet performance conditions such as the prevention of waste and safe bottom hole pressure. Also as in the Canadian Arctic offshore, the casing must be pressure tested to withstand maximum anticipated operating pressure.

³¹⁷ Petroleum Safety Authority Norway, *Regulations Relating to Design and Outfitting of Facilities, etc. in the Petroleum Activities (The Facilities Regulations)*, <http://www.ptil.no/facilities/category400.html#Toc280616925>, Section 48.

³¹⁸ Ibid., Section 52.

³¹⁹ Petroleum Safety Authority Norway, *Guidelines Regarding the Facilities Regulations*, Section 52, <http://www.ptil.no/activities/category404.html>.

³²⁰ Standards Norway, *NORSOK Standard D-010: Well Integrity in Drilling and Well Operations*, 2004, Section 5.6, Table 2, 22 and 24, <http://www.standard.no/PageFiles/1315/D-010r3.pdf>.

³²¹ Ibid., Section 5.6, Table 2.

³²² Ibid., Section 5.6, Table 22.

³²³ Ibid., Section 5.6, Table 24.

4.4 Well testing requirements

4.4.1 Canadian Arctic Offshore

The well production test regulations in the Canadian Arctic offshore are a mainly performance-based with some prescriptive requirements. Section 51 and 52 of the *Canada Oil and Gas Drilling and Production Regulations* requires that every formation in a well be tested to obtain data on the productivity of the well, characteristics of the reservoir and sample of formation fluids.³²⁴ No well may be put into production until a formation flow test has been approved by the NEB.³²⁵ The operator must submit a detailed testing program with the expectation that it will be approved by the Board if the test will “be conducted safely, without pollution and in accordance with good oilfield practices.”³²⁶ A formation flow test must also be conducted if the well operation changes its “deliverability, productivity or injectivity.”³²⁷

4.4.2 United States

The regulations for well production tests in the United States are prescriptive. When an operator intends to conduct a well test, they must include the test plans with the Application for Permit to Drill (APD) or Application for Permit to Modify (APM). The plan must include:

- “(1) Estimated flowing and shut-in tubing pressures;
- (2) Estimated flow rates and cumulative volumes;
- (3) Time duration of flow, buildup, and drawdown periods;
- (4) Description and rating of surface and subsurface test equipment;
- (5) Schematic drawing, showing the layout of test equipment;
- (6) Description of safety equipment, including gas detectors and fire-fighting equipment;
- (7) Proposed methods to handle or transport produced fluids; and
- (8) Description of the test procedures.”³²⁸

In addition to the APD and APM requirements, 24-hour notice must be given to the District Manager before testing the well.³²⁹ There are no reporting requirements for well production tests specified in the regulations.

³²⁴ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 51-52, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

³²⁵ *Ibid.*, Section 52.

³²⁶ *Ibid.*, Section 52,4.

³²⁷ *Ibid.*, Section 52, 1, b.

³²⁸ “What are the requirements for conducting a well test,” U.S. Code of Federal Regulations Title 30, Pt. 250.460.

³²⁹ *Ibid.*

Comparison to the Canadian Arctic Offshore

In the U.S. the regulations require the operator to submit detailed information to the regulator on the well production test plans. Unlike the regulations for the Canadian Arctic offshore, there are no performance-based requirements that must be met and no reporting requirements are specified.

4.4.3 United Kingdom

In the U.K. there are no particular requirements for well testing in the regulations. That being said, in Schedule 3 of the *Safety Case Regulations*, details are provided on the “particulars to be included in a safety case for a non-production installation.”³³⁰ Although there is no specific reference to well testing, it would need to be included by the operator in their safety case submission to the HSE.

Comparison to the Canadian Arctic Offshore

Unlike in the Canadian Arctic offshore there are no particular references in the legislation or regulation to well test requirements in the U.K. However, it would need to be included by the operator in their safety case submission.

4.4.4 Greenland

The March 2010 Exploration Drilling Guidelines specify that a well test program be submitted to the BMP for approval prior to conducting a formation test.³³¹ The well test must be conducted with particular safety precautions including operation during daylight hours, under safe weather and wind conditions and with caution to prevent escape of fluids to the environment or damage to the well.³³² The guidelines indicate how the drilling rig should be prepared for operation before production testing, how well perforation should be carried out and identify safety requirement for the use of other equipment that might be a hazard in connection with the use of explosives.³³³

Reporting requirements for the production test are included in Section 12.4 of the Guidelines.³³⁴ Additional requirements for well test requirements can be specified in a licence or an approval letter from the BMP.

³³⁰ U.K. Health and Safety Executive, *The Offshore Installations (Safety Case) Regulations 2005*, http://www.legislation.gov.uk/ukxi/2005/3117/made_Schedule_3.

³³¹ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010. http://www.bmp.gl/images/stories/petroleum/bmp_Exploration_Drilling_Guidelines_March_2010.pdf, Section 8.1.

³³² Ibid., Section 8.2.

³³³ Ibid., Section 8.3-8.5.

³³⁴ Ibid., Section 12.4.

Comparison to the Canadian Arctic Offshore

As in the Canadian Arctic offshore, the well test plan must be approved by the regulator in Greenland. Also as in the Canadian Arctic offshore, an emphasis is placed on the safety of the well test, and reporting requirements are provided.

4.4.5 Norway

In Norway the regulations provide overall requirements for well testing based on the well barrier principle. The PSA *Facilities Regulations* Section 48 require that all well barriers be tested to verify their performance.³³⁵

The *Activities Regulations* Section 87 also refers to formation testing, test production, clean-up and stimulation of the well.³³⁶ The *Activities Regulations* reference Norsok D-010 standard, which recommends a number of well testing activities to verify well integrity. The Norsok D-010 standard defines the well test design and well test design schematic under various scenarios.³³⁷

Comparison to the Canadian Arctic Offshore

As in regulations for the Canadian Arctic offshore, Norway requires the operator to meet performance-based conditions; in Norway these are defined by the well barrier principle. However, no details are provided in Norway on the well test plan submission requirements or reporting of the test results.

³³⁵ Petroleum Safety Authority Norway, *Regulations Relating to Design and Outfitting of Facilities, etc. in the Petroleum Activities (The Facilities Regulations)*, Section 48 <http://www.ptil.no/facilities/category400.html>, .

³³⁶ Petroleum Safety Authority Norway, *Regulations Relating to Conducting Petroleum Activities (The Activities Regulations)*, Section 87, <http://www.ptil.no/activities/category399.html>.

³³⁷ Standards Norway, *NORSOK Standard D-010: Well Integrity in Drilling and Well Operations*, 2004, <http://www.standard.no/PageFiles/1315/D-010r3.pdf>.

5. Facility and Drilling System Requirements

This chapter examines the facility and drilling system requirements for offshore drilling platforms in the Canadian Arctic, the U.S., the U.K., Greenland, and Norway. In contrast to the previous chapter on subsurface drilling and well activities, this chapter focuses on those regulations that are directly relevant to the surface operations of the drilling platform. Drilling fluid control systems, emergency shutdown systems, fire and gas systems, hazardous area classification and dynamic positioning systems are all examined as part of facility and drilling system requirements. A comparison of these requirements among all jurisdictions is made in Table 6 (below).

Drilling Fluid Control System

A drilling fluid control system manages the mud used during drilling operations. More specifically, a drilling fluid control system controls a) the type and amount of solids used, b) the chemical properties and c) the circulation and temperature of drilling fluids.

Emergency shutdown systems

Emergency shutdown systems (ESD) are intended to reduce the consequences from uncontrolled flooding, escape of hydrocarbons or fire in an area with hydrocarbons or other hazards associated with offshore drilling and production. Typically, an ESD shuts down part of an offshore installation's systems and equipment, isolates hydrocarbon inventories and stops hydrocarbon flow, isolates electrical equipment, prevents the escalation of events, depressurizes the system, controls emergency ventilation and closes watertight and fireproof doors.³³⁸

Fire and gas systems

Fire and gas systems detect, alert and mitigate fire, heat, smoke and toxic/flammable gas releases using a variety of sensors. Typically on offshore installations, a fire and gas system triggers an emergency shutdown system and operates a sprinkler system in open areas and clean agents in enclosed areas.³³⁹

³³⁸ Kongsberg Maritime, *Oil and Gas Emergency ShutDown System*, <http://www.km.kongsberg.com/ks/web/nokbg0240.nsf/AllWeb/27440FE5DAB88FC6C1256A6C0043EBC3?OpenDocument>.

³³⁹ C.R. Raju, "Quantitative Optimization of Offshore Fire and Gas Systems Using IEC 61511 (ANSI/ISA-84)," (paper presented at the SPE Annual Technical Conference and Exhibition, Anaheim, California, November 11-14, 2007).

Hazardous area classifications

Hazardous area classifications, developed by various standards organizations, are applied to equipment to describe the equipment's suitability for use in certain hazardous conditions. The design criteria for hazardous area classification typically take into account "the probability of an explosive mixture being present, the type of combustible material and the spark energy or temperature required to ignite the combustible material likely to be present."³⁴⁰

Dynamic positioning systems

Dynamic positioning systems (DPS) enable floating offshore drilling rigs to maintain their position over an offshore well without the use of fixed mooring anchors (Section 5.5). Typically, thrusters, located in the hulls of the drilling rig, are automatically activated by a sensing system to maintain the rig's location.

³⁴⁰ J.J. Hinds, "Hazardous Area Classifications and Definitions," (paper presented at the SPE/IADC Drilling Conference, Dallas, Texas, February 28, 1988).

Table 6. Comparison of facility and drilling system regulations by jurisdiction to Canadian Arctic Offshore

Regulatory Topic	Canadian Arctic Offshore	United States	United Kingdom	Greenland	Norway
1. Drilling fluid control system	Must provide an effective barrier against formation pressure, allow for proper well evaluation, ensure safe drilling operations and prevent pollution.	Must design and implement a drilling fluid program that addresses safe practices, testing and monitoring equipment, drilling fluid quantities and drilling fluid-handling areas.	So far as reasonably practicable, have no unplanned escape of fluids from a well.	It must be possible to handle drilling fluid loss or to increase fluid density quickly.	Must mix, store, circulate and clean a sufficient volume of drilling fluid to maintain the fluid's drilling and barrier functions.
	Must strategically locate indicators and alarms of drilling fluid control system.	Specific regulations on where alarms should be located.	No mention of indicators or alarms in reference to drilling fluid control systems.	No mention of indicators or alarms in reference to drilling fluid control systems.	No specific regulations on location of indicators and alarms of drilling fluid control systems.
	Must store sufficient quantities of drilling fluid.	Must use, maintain and replenish quantities of drilling fluid as necessary to ensure well control – based on anticipated drilling conditions, rig storage capacity, weather conditions and estimated time for delivery.	No mention of storage of drilling fluid.	Sufficient stocks of drilling fluid components must be kept on the offshore installation, including stocks to handle possible hydrogen sulphide.	Must store sufficient volume of drilling fluid.
	Must store and handle drilling fluid to minimize deterioration, ensure safety and prevent pollution.	Specific safety requirements for drilling fluid handling areas and safe practices for drilling fluid program. Specific requirements for properly condition drilling fluid to avoid deterioration. No	Risks to health and safety of persons from drilling fluid must be low as reasonably practicable. No unplanned escape of drilling fluids.	Oil based fluids or fluids containing chemicals that are particularly detrimental to human health or the environment can only be used if approved	Must mix, store, circulate and clean a sufficient volume of drilling fluid to maintain the fluid's drilling and barrier functions. High pressure section of drilling fluid system

Facility and Drilling System Requirements

		explicit reference to preventing pollution.		by the Bureau of Minerals and Petroleum.	must be able to control well pressure at all times. No mention on pollution prevention with respect to drilling fluid.
2. Emergency shutdown systems (ESD)	ESD required on all offshore installations.	No reference for ESD being required on offshore installations.	No reference for ESD being required on offshore installations. However, performance-based regulations exist for the prevention of fire and explosions.	No requirement for ESD on offshore installations. More generally, health and safety risks must be identified, assessed and reduced as much as practicably possible. Although an installation's licence and approval letter could stipulate requirements for ESD.	ESD required on all offshore installations.
	Detailed regulations on audio/visual signals, levels and order of shutdown and location of shutdown stations, power and cable lines and safety control valves.	Specific regulations address ESD testing frequency, surface and subsurface safety valves, ESD valves and location of ESD schematics and ESD for diesel engines.	No specific regulations on ESD.	No specific regulation on ESD. Although an installation's licence and approval letter could stipulate requirements for ESD.	Specifically all ESD must a) function independently from other systems b) can enter or maintain safe conditions if a fault occurs c) have a clear and simple command structure d) be activated by multiple, remote locations and e) stop releases of hydrocarbons and chemicals to and from the facility.
	Producing wells must comply with API RP 14C	ESD required to conform to API RP 14C	No specific regulations on ESD standards	No specific regulation on ESD standards. Although an installation's licence	No specific regulation on ESD standards, although recommended to adhere to NS-EN ISO

Facility and Drilling System Requirements

				and approval letter could stipulate requirements for ESD.	13702 Chapters 6 and 7 and Appendices B.2 and B.3 along with NORSOK S-001 Chapter 10.
3. Fire and gas systems	No overarching regulations specifically on fire and gas systems.	Fire and gas system description required in an Application for Permit to Drill.	No specific regulations on fire and gas systems.	No specific regulation on fire and gas systems, although such requirements could be included in a licence or an approval letter.	Redundancy is required in fire and gas systems.
	Many specific regulations on components of a fire and gas system (e.g. water mains, fire-extinguishing systems, alarm systems).	Many specific regulations on components of fire and gas system (fire-extinguishing equipment, prescriptive regulations enforce API RP 14C, 14G, 14F, and 14FZ) shared between BOEMRE and USCG.	No specific regulations on components of fire and gas system.	No regulations on components of a fire and gas system, although such requirements could be included in a licence or an approval letter.	Specific regulations exist for gas release systems, firewater supply, fixed firefighting systems, manual firefighting and firefighters' equipment.
	Performance-based requirements on prevention of incidents (includes fire and explosions).	Overarching performance-based regulation requiring operators "must immediately control, remove or otherwise correct any hazardous oil and gas accumulation or other health, safety, or fire hazard."	Performance-based requirement for offshore installations to mitigate the effects of fire and explosion.	Performance-based provision that health and safety risks must be identified, assessed and reduced as much as practicably possible.	Performance-based requirement that fire and gas systems must be strategic to allow for quick and reliable detection of near-fires, fires or gas leaks.
4. Hazardous area classification	Offshore installations must adhere to the classification system in API RP	USCG regulates through compliance with NFPA NEC 2002 and IEC Code 60079-0; BOEMRE requires all drilling facilities	No requirement to adhere to international standards on hazardous area classification, although requires offshore installations to	No specific requirement to adhere to international standards on hazardous area classification,	No requirement to adhere to international standards on hazardous area classification, although hazardous area must be classified

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	500.	to use API RP 500 or 505.	generally identify and designate hazardous areas.	although such requirements could be included in a licence or an approval letter.	so that the design and location of areas and equipment reduce the risk from fires and explosions.
	Specific regulations exist for access to and ventilation of hazardous areas.	USCG also has specific regulations for classified areas as well.	No specific regulations on hazardous area classification.	No specific regulations on hazardous area classifications, although such requirements could be included in a licence or an approval letter.	No specific regulations on hazardous area classifications.
5. Dynamic position system (DPS)	DPS must be designed with built-in redundancy OR failure of any individual part will not result in major damage to the platform OR routine replacement reduces an annual failure rate to no greater than 0.1.	There are no regulations on performance or redundancy of DPS.	Other than the implicit consideration of DPS effectiveness in the safety case, there are no regulations on performance or redundancy of DPS.	There are no general requirements for DPS, only that more generally, health and safety risks must be identified, assessed and reduced as much as practicably possible, although such requirements could be included in a licence or an approval letter.	More broadly, offshore platforms using a DPS must implement “necessary measures” to reduce the probability of hazard and accident situations. DPS is required to have redundancy by maintaining position during failures and damage to the DPS as well as during accidents.
	Specific regulations exist for a) an alert and response display system for a DPS that shows the amount of available power to maintain position and allow for continued operation and b) a	There are no specific regulations on DPS.	There are no specific regulations on DPS.	There are no specific regulations on DPS, although such requirements could be included in a licence or an approval letter.	There are no specific regulations on DPS.

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	description of the performance capability of the DPS in a variety of situations.				
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5.1 Drilling fluid control system

5.1.1 Canadian Arctic Offshore

Section 28 of the *Canada Oil and Gas Drilling and Production Regulations* requires the design of a drilling fluid system that ensures:

- a) “the drilling fluid system and associated monitoring equipment is designed, installed, operated and maintained to provide an effective barrier against formation pressure, to allow for proper well evaluation, to ensure safe drilling operations and to prevent pollution; and
- b) the indicators and alarms associated with the monitoring equipment are strategically located on the drilling rig to alert onsite personnel.”³⁴¹

In addition to the overall drilling fluid system, the *Canada Oil and Gas Drilling and Production Regulations* also require several additional considerations of drilling fluid management. Section 9(h) requires, as part of the requisite environmental protection plan, a description of handling waste material (including drilling fluid).³⁴² Section 42(d) requires that all well completions³⁴³ control sand production so that they do not create a safety hazard or create waste.³⁴⁴ Section 22 details that drilling fluids should be:

- a) “readily available and stored on an installation in quantities sufficient for any normal and reasonably foreseeable emergency condition;
- b) stored and handled in a manner that minimizes their deterioration, ensures safety and prevents pollution.”³⁴⁵

Safe handling of drilling fluids is required under Section 23 “in a way that does not create a hazard to safety or the environment.”³⁴⁶

Regarding fire-extinguishing systems in areas where drilling fluids are used, Section 28 of the *Canada Oil and Gas Drilling and Production Regulations* requires that in every offshore installation, “a fixed fire-extinguishing system utilizing carbon dioxide, pressure water spray or, where a fire will not involve any gases, liquefied gases with a boiling point below ambient temperature or cryogenic liquids, high expansion foam shall be installed in every space containing... mud pits or equipment used for removing drill solids where oil-based mud is used.”³⁴⁷

³⁴¹ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations* SOR/2009-315, Section 28, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>

³⁴² Ibid., Section 9(h).

³⁴³ A well is considered completed when it is prepared for production or injection operations.

³⁴⁴ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, Section 42(d).

³⁴⁵ Ibid., Section 22.

³⁴⁶ Ibid., Section 23.

³⁴⁷ Ibid., Section 28.

5.1.2 United States

Generally, in the United States, under 30 CFR 250.455, all offshore drilling proponents must “design and implement [a] drilling fluid program to prevent the loss of well control. This program must address drilling fluid safe practices, testing and monitoring equipment, drilling fluid quantities, and drilling fluid-handling areas.”³⁴⁸ Specific required safe practices for a drilling fluid program are listed in 30 CFR 250.456.³⁴⁹ The equipment required to monitor drilling fluids is identified in 30 CFR 450.457.³⁵⁰ 30 CFR 250.456 notes what quantities of drilling fluids are required and the specific safety requirements for drilling fluid handling areas are outlined in 30 CFR 250.459.³⁵¹

Comparison to the Canadian Arctic Offshore

U.S. drilling fluid control system regulations are very similar to those in the Canadian Arctic offshore. Both jurisdictions have performance-based and specific requirements for these systems, including location of alarms, storage and handling of drilling fluid. Unlike the Canadian Arctic offshore, however, the U.S. does not explicitly mention preventing pollution as one of the performance-based goals.

5.1.3 United Kingdom

In the U.K., there are limited regulations that guide drilling fluid control systems. Section 13 of Part IV of *The Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996*, states that, generally, “so far as is reasonable practicable, there can be no unplanned escape of fluids from the well; risks to the health and safety of persons from it or anything in it, or in strata to which it is connected, are as low as is reasonably practicable.”³⁵²

Despite the existence of these performance-based regulations, there remains an assortment of regulations that impact offshore drilling fluid control systems. Offshore drilling operations are required to provide the drilling fluid density in regularly scheduled reports to the Health and Safety Executive.³⁵³ If an offshore drilling unit were to export any drill cuttings to another field for reinjection, they would require a licence under the *Food and Environment Protection Act 1985* (FEPA), otherwise they are exempt under FEPA.³⁵⁴ Any drilling fluids contained in the waste stream for reinjection, either onsite or offsite, need a permit under Section 3 of the

³⁴⁸ “What are the general requirements for a drilling program?”, U.S. Code of Federal Regulations Title 30, Pt. 250.455.

³⁴⁹ “What safe practices must the drilling fluid program follow?”, U.S. Code of Federal Regulations Title 30, Pt. 250.456.

³⁵⁰ “What equipment is required to monitor drilling fluids?”, U.S. Code of Federal Regulations Title 30, Pt. 250.457.

³⁵¹ “What are the safety requirements for drilling fluid-handling areas?”, U.S. Code of Federal Regulations Title 30, Pt. 250.459.

³⁵² Government of the U.K., *The Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996* Statutory Instrument 1996, No. 913, <http://www.legislation.gov.uk/uksi/1996/913/contents/made>

³⁵³ *Ibid.*, Section 19(1)(e).

³⁵⁴ Oil & Gas U.K., “Reinjection of Mud and Cuttings,” Environmental Legislation website, http://www.ukooaenvironmentallegislation.co.uk/Contents/Topic_Files/Offshore/Reinjection.htm.

Offshore Chemicals Regulations 2002.³⁵⁵ A 2005 amendment to the *Offshore Chemicals Regulations 2002* increased the powers of DEEC inspectors to investigate non-compliance and risk of significant pollution from chemical discharges.³⁵⁶

Comparison to the Canadian Arctic Offshore

Unlike the Canadian Arctic offshore, U.K. regulations on drilling fluid control systems are largely performance-based, with the prohibition of unplanned escape of drilling fluid and the minimization of health and safety risks from drilling fluid. No specific regulations exist on the indicators and alarms of drilling fluid control systems or storage of drilling fluid.

5.1.4 Greenland

While Greenland has developed mandatory guidelines that describe what should be contained in a ‘Mud Programme.’ Specifically the program should provide:

- a) A detailed description of the types of drilling fluid to be used specifying density, rheological properties, etc.
- b) A detailed description of the components of the drilling fluids. Reference may be made to relevant chemical data sheets.
- c) A detailed description of check equipment and procedures for the drilling fluid or reference to relevant standard, which will be, followed (e.g. API RP 13B).
- d) Procedure for monitoring the drilling fluid volume.³⁵⁷
- e) A list of the quantities of safety related material (e.g. barite and cement) to be stored on the drilling rig during normal operations and an argumentation for these quantities.
- f) A plot of the mud program and casing plan in relation to the expected pore pressure and fracture gradient with depth (including most likely scenario, high and low side).
- g) Documentation for the calculations of the expected pressures and gradients.³⁵⁸

Furthermore, there are additional provisions in the March 2010 Exploration Drilling Guidelines on the management of drilling fluid. It must be possible to handle drilling fluid loss or to increase fluid density quickly. Sufficient stocks of drilling fluid components must be kept on the offshore installation, including stocks to handle possible hydrogen sulphide.³⁵⁹ Drilling fluid reconditioning equipment must be used when possible during drilling to separated gas and

³⁵⁵ Government of the U.K., *The Offshore Chemicals Regulations 2002* Statutory Instrument 2002, No. 1355, <http://www.legislation.gov.uk/ukxi/2002/1355/made>

³⁵⁶ Government of the U.K., *The Offshore Petroleum Activities (Oil Pollution Prevention and Control) Regulations 2005* Statutory Instrument 2005, No. 2055, Schedule 2, <http://www.legislation.gov.uk/ukxi/2005/2055/schedule/2/made>

³⁵⁷ See also Section 5.9 of Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf, 13.

³⁵⁸ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, Section 4.11, http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf, 9.

³⁵⁹ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, Section 5.8, http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf, 13.

cuttings from the fluid.³⁶⁰ Drilling fluid density is to be tested at least every hour.³⁶¹ Oil based fluids or fluids containing chemicals that are particularly detrimental to human health or the environment can only be used if approved by the Bureau of Minerals and Petroleum.³⁶² A Drilling Fluid Selection and Cuttings Discharge Plan is also required as part of an environmental impact assessment.³⁶³

Comparison to the Canadian Arctic Offshore

Similar to the Canadian Arctic offshore, Greenland has both performance-based and prescriptive regulations on drilling fluid control systems, covering many of the aspects of these systems that Canada’s National Energy Board regulates. However, unlike the regulations for the Canadian Arctic offshore, Greenland does not explicitly address the indicator and alarm systems for drilling fluid control systems,

5.1.5 Norway

In Norway, a drilling fluid system is required under Section 51 of the *Regulations Relating to Design and Outfitting of Facilities, etc. in the Petroleum Activities (the Facilities Regulations)*. More specifically, this system shall mix, store, circulate and clean a sufficient volume of drilling fluid to “safeguard the drilling fluid’s drilling and barrier functions.”³⁶⁴ Section 51 also has the performance-based regulation that the “high pressure section of the drilling fluid system with associated systems shall also have the capacity and working pressure to be able to control the well pressure at all times.”³⁶⁵ Guidelines for Section 51 recommend following the NORSOK D-001 standard that details what components should be in mud mixing and storage systems, high pressure mud systems and mud treatment systems, but this is not required.^{366,367}

Comparison to the Canadian Arctic Offshore

The regulations for the Canadian Arctic offshore and Norway are similar on drilling fluid control systems. Both jurisdictions require that drilling fluid must be handled to ensure that drilling and barrier functions are maintained. Both countries require a sufficient volume of drilling fluid be stored on-site. Unlike the Canadian Arctic offshore, Norway does not specifically address the

³⁶⁰ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, Section 5.10, http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf, 13.

³⁶¹ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, Section 5.11, http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf, 13.

³⁶² Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, Section 5.12, http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf, 13.

³⁶³ *Ibid.*, 28.

³⁶⁴ Petroleum Safety Authority Norway, *Regulations Relating to Design and Outfitting of Facilities, etc. in the Petroleum Activities (The Facilities Regulations)*, 2010, <http://www.ptil.no/facilities/category400.html>.

³⁶⁵ *Ibid.*

³⁶⁶ Petroleum Safety Authority Norway, *Guidelines Regarding the Facilities Regulations*, 2010, Section 51, <http://www.ptil.no/facilities/category405.html>

³⁶⁷ Norwegian Technology Standards Institution, *NORSOK Standard: Drilling Facilities D-001*, 1998, Section 5.7-5.9, <http://www.standard.no/PageFiles/1318/D-001.pdf>

goal of pollution prevention from drilling fluid or alarm systems for drilling fluid control systems.

5.2 Emergency shutdown systems

5.2.1 Canadian Arctic Offshore

In the Canadian Arctic offshore, there are specific and detailed regulations for ESDs under Section 18 of the *Canada Oil and Gas Installations Regulations*.³⁶⁸ Specific regulations on well control (Christmas tree and BOP testing) are listed in Chapter 6. Every offshore drilling rig is required to have an ESD that can shut down and isolate all potential sources of ignition and sources of flammable liquids or gases.³⁶⁹ Details are given on audible and visual signals for the ESD, the levels and order of shutdown, location of shutdown stations and safety control valves.³⁷⁰

If the offshore installation is producing then, Section 18(3) requires an ESD to have at least two levels of shutdown, and that the following must occur in the time and sequence described in the operations manual:

- i. “the shutdown of all production facilities and associated test facilities,
- ii. the closure of all surface inlet manifold safety valves and production riser safety valves,
- iii. the closure of all Christmas tree safety valves and all downhole safety valves, and
- iv. the shutdown of all utilities except the equipment listed in subsection 12(1).”³⁷¹

Furthermore, all producing offshore installations must have an ESD, under Section 18(4), that complies with the American Petroleum Institute RP 14C (Recommended Practice for Analysis, Design, Installation and Testing of Basic Surface Safety Systems for Offshore Production Platforms) and if the ESD is activated, the “surface-controlled subsurface safety valve shall close in not more than two minutes after the Christmas tree safety valve has closed, except where a longer delay is justified by the mechanical or production characteristics of the well.”³⁷²

If the offshore installation is drilling, then an ESD must ensure that a) time and sequence of shutdown, as stated in the operations manual, is followed and b) shutdown can occur from at least two strategic locations.³⁷³

Section 18 also requires selective shutdown of certain ventilation systems, an ESD control station outside of hazardous areas, the ability to stay in a locked-out condition until the ESD is manually reset, a back-up power source with audio/visual alarms, and specific regulations for a hydraulic or pneumatic accumulator. In the event of a failure of the accumulator the shutdown

³⁶⁸ Government of Canada, *Canada Oil and Gas Installations Regulations* SOR/96-118, Section 18, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-118/FullText.html>

³⁶⁹ *Ibid.*, Section 18(1).

³⁷⁰ *Ibid.*, Section 18(2).

³⁷¹ *Ibid.*, Section 18(3).

³⁷² *Ibid.*, Section 18(13).

³⁷³ *Ibid.*, Section 18(15).

valves must revert to a fail-safe mode.³⁷⁴ Also, any cables and pneumatic and hydraulic power lines that are part of an ESD must (if they are at risk) be protected and as much as possible be routed away from the process and utility controls systems, so that if they are damaged it will not affect the ESD.³⁷⁵

5.2.2 United States

The Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) is responsible for safety regulations, including ESDs, for offshore energy projects.³⁷⁶ These regulations appear in the Code of Federal Regulations under *Title 30: Mineral Resources, Part 250 – Oil and Gas and Sulphur Operations in the Outer Continental Shelf*. Section 250.803(b)(4) requires an ESD to conform to the API Recommended Practice 14C (Recommended Practice for Analysis, Design, Installation, and Testing of Basic Surface Safety Systems for Offshore Production Platforms).³⁷⁷

Besides the requirement to follow API RP 14C, there is an assortment of other specific regulations that impact aspects of an ESD. For instance, diesel engines have specific regulations for ESDs.³⁷⁸ Regulations also exist that outline the location of a manually controlled station for an ESD for drilling platforms at various stages of development.³⁷⁹ Section 250.801(h)(4)(i) requires that in addition to manual ESD stations, an ESD must be able to be activated from a remote location.³⁸⁰ There are also specific regulations on surface and sub-surface safety valves, ESD valves and the location of ESD schematics.³⁸¹ ESDs are also required to be tested monthly.³⁸²

Comparison to the Canadian Arctic Offshore

Unlike the Canadian Arctic offshore, the U.S. does not require ESD on all offshore installations. However, both require adherence to API RP 14C and both have specific regulations on the operation and installation of ESD, including ESD safety valves and location of ESD.

³⁷⁴ Ibid., Section 18(11).

³⁷⁵ Ibid., Section 18(12).

³⁷⁶ *Memorandum of Agreement between the Minerals Management Service – U.S. Department of the Interior and the U.S. Coast Guard – U.S. Department of Homeland Security: Floating Offshore Facilities*, MMS/USCG MOA: OCS-04, February 28, 2008, <http://www.boemre.gov/regcompliance/MOU/PDFs/MOA-USCG04FloatingFacilities-Final.pdf>.

³⁷⁷ “Additional production system requirements,” U.S. Code of Federal Regulation Title 30, Pt. 250.803.4

³⁷⁸ “What are the safety requirements for diesel engines used on a drilling rig?,” U.S. Code of Federal Regulation Title 30, Pt 250.405

³⁷⁹ “Part 250 – Oil and Gas and Sulphur Operations in the Outer Continental Shelf,” U.S. Code of Federal Regulation Title 30, Pt. 250.406, Pt. 250.503, Pt. 250.603

³⁸⁰ “Additional production system requirements,” U.S. Code of Federal Regulation Title 30, Pt. 250.803.3(i)

³⁸¹ Ibid., Pt.250.803(b)(4)(i-iii).

³⁸² “Production safety-system testing and records,” U.S. Code of Federal Regulation Title 30, Pt. 250.804(a)11.

5.2.3 United Kingdom

There are no specific requirements for an ESD in the U.K.; rather, many performance-based regulations exist. For instance, *The Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995* state the general duty of the offshore installation operator is to prevent fire and explosions, including measures to:

- a) Ensure the safe production, processing, use, storage, handling, treatment, movement and other dealings with flammable and explosive substances
- b) Prevent the uncontrolled release of flammable or explosive substances
- c) Prevent the unwanted or unnecessary accumulation of combustible, flammable or explosive substances or atmospheres; and
- d) Prevent the ignitions of such substances and atmospheres.³⁸³

The Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995 also have discretionary performance-based regulations in place for detection of incidents, communication, control of emergencies, mitigation of fire and explosion, muster areas, etc.³⁸⁴

The Pipelines Safety Regulations 1996 (Schedule 3) require emergency shutdown valves to be in place on all major accident hazard pipelines that are connected to an offshore installation.³⁸⁵

Comparison to the Canadian Arctic Offshore

In contrast to the Canadian Arctic offshore, ESD are not required on all offshore installations and there are no specific regulations on ESD. Instead, the U.K. largely follows performance-based regulations on safety management.

5.2.4 Greenland

ESD are not described in the *Mineral Resources Act* or in the Bureau of Minerals and Petroleum March 2010 Exploration Drilling Guidelines. As offshore drilling and production regulations remain under development, ESD may be considered a requirement in future amendments or regulations. In the meantime, while not being explicit, an offshore installation's licence and approval letter can both carry stipulations that address ESD. The Petroleum Exploration Drilling Guidelines specify that operators are expected to have a Safety Management System under which "appropriate measures are in place to manage and control the hazards." While this could include an emergency shutdown system, this is not explicitly mentioned in the document.³⁸⁶

³⁸³ Government of the U.K., *The Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995*, Statutory Instrument 1995, No. 743, Section 9, <http://www.legislation.gov.uk/ukSI/1995/743/made>

³⁸⁴ *Ibid.*, Section 10-15.

³⁸⁵ Government of the U.K., *The Pipeline Safety Regulations 1996*, Statutory Instrument 1996, No. 825, Sections 19 and Schedule 3, <http://www.legislation.gov.uk/ukSI/1996/825/made>

³⁸⁶ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, Section 4.11, http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf, 5.

Comparison to the Canadian Arctic Offshore

Compared to the Canadian Arctic offshore, Greenland has no explicit requirement for ESD on offshore installations and no specific regulations or guidelines on ESD, although such requirements could be included in a licence or an approval letter.

5.2.5 Norway

In Norway, Section 33 of the *Regulations Relating to Design and Outfitting of Facilities, etc. in the Petroleum Activities (the Facilities Regulations)* explicitly mentions ESD.³⁸⁷ It states that all facilities must have an ESD “that can prevent the development of hazard and accident situations and limit the consequences of accidents.”³⁸⁸ This system must be able to function independently of other systems. In particular Section 33 mentions that the ESD shall:

- a) be designed so that it “enters or maintains safe conditions if a fault occurs that can prevent the system from functioning.”³⁸⁹
- b) have a simple and clear command structure.
- c) be capable of being activated manually from trigger stations that are located in strategic locations on the facility. It shall be possible to manually activate functions from the central control room that bring the facility to a safe condition in the event of a fault in the parts of the system that can be programmed.
- d) include emergency shutdown valves that can stop releases of hydrocarbons and chemicals to and from the facility, and which isolate the facility's fire areas.³⁹⁰

Guidelines that accompany Section 33 recommend using the standards NS-EN ISO 13702 Chapters 6 and 7 and Appendices B.2 and B.3 along with NORSOK S-001 Chapter 10.³⁹¹

Comparison to the Canadian Arctic Offshore

Similar to the Canadian Arctic offshore, ESD are required on all offshore installations in Norway. However Norway has no prescriptive regulations on the operation of ESD. Moreover, and unlike the regulations for the Canadian Arctic offshore, Norway has detailed performance-based regulations on ESD functionality. Adherence to specific standards on ESD are recommended but not required as in the U.S. and the Canadian Arctic offshore.

³⁸⁷ Petroleum Safety Authority Norway, *Regulations Relating to Design and Outfitting of Facilities, etc. in the Petroleum Activities (The Facilities Regulations)*, 2010, Section 33, <http://www.ptil.no/facilities/category400.html>

³⁸⁸ Ibid.

³⁸⁹ Ibid.

³⁹⁰ Ibid.

³⁹¹ Petroleum Safety Authority Norway, *Guidelines Regarding the Facilities Regulations*, 2010, Re: Section 33, <http://www.ptil.no/facilities/category405.html>

5.3 Fire and gas systems

5.3.1 Canadian Arctic Offshore

In Canada's offshore Arctic waters, there is no over-arching regulation that covers a fire and gas system on offshore installations. Rather, a suite of specific prescriptive regulations from the *Canada Oil and Gas Installations Regulations* are enforced that address various aspects of a fire and gas system.

Fire hydrant systems, as described in Section 24, are required on every offshore installation.³⁹² Each fire hydrant system must be connected to a continuously pressurized wet pipe water main serviced by at least two redundant pump systems.³⁹³ Specific regulations are given if any of the pump systems is out of operation.³⁹⁴ The number and position of fire hydrants is also regulated, along with the specifications of fire hoses.³⁹⁵

Water deluge and water monitor systems in areas with petroleum are regulated according to Section 25 of the *Canada Oil and Gas Installations Regulations*. Section 25(2) requires every manned offshore installation in areas that store, convey or process petroleum not used as fuel on the installation to have a water deluge system or a water monitor system, in the case of open spaces.³⁹⁶ Specific regulations are given on the redundancy of pump systems and the control and automation of the water deluge system.³⁹⁷ Further, all water deluge systems must adhere to NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*.³⁹⁸ Regulations for water monitoring systems are detailed in Section 25(5).³⁹⁹

General requirements for fire pump systems and water mains are detailed in Section 26 of the *Canada Oil and Gas Installations Regulations*, including information on location and use of water mains, location, operation and redundancy of pump systems, audible and visual alarms.⁴⁰⁰

Section 27 of the *Canada Oil and Gas Installations Regulations* addresses sprinkler systems in accommodation areas. Generally, sprinkler systems are required to be installed in accordance with NFPA13, *Standard for the Installation of Sprinkler Systems* and tested and maintained in accordance with NFPA 13A, *Recommended Practice for the Inspection, Testing and Maintenance of Sprinkler Systems*.⁴⁰¹ In addition, sprinkler systems in accommodation areas are

³⁹² Government of Canada, *Canada Oil and Gas Installations Regulations* SOR/96-118, Section 24(1), <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-118/FullText.html>

³⁹³ Ibid., Section 24(2).

³⁹⁴ Ibid., Section 24(2)(b).

³⁹⁵ Ibid., Section 24(3-4).

³⁹⁶ Ibid., Section 25(2).

³⁹⁷ Ibid., Section 24(3-4) and Section 25(4).

³⁹⁸ Ibid., Section 25(6).

³⁹⁹ Ibid., Section 25(5).

⁴⁰⁰ Ibid., Section 26(3-5).

⁴⁰¹ Ibid., Section 27(11).

required to follow additional regulations on the operation, location, redundancy, automation, alarm system and stop valves of sprinkler systems in accommodation areas.⁴⁰²

Fire-extinguishing systems in machinery and flammable liquid storage spaces are regulated under Section 28 of the *Canada Oil and Gas Installations Regulations*. The spaces where fire-extinguishing systems are required are listed in Section 28(1-2).⁴⁰³ Carbon dioxide fire-extinguishing systems are required to meet NFPA 12, *Standard on Carbon Dioxide Extinguishing Systems*.⁴⁰⁴ Pressure water spray fire-extinguishing systems are required to adhere to NFPA 15, *Standard for Water Spray Fixed Systems for Fire Protection*.⁴⁰⁵ High expansion foam fire-extinguishing systems are required to meet the standards outlined in SFPA 16, *Standard on Deluge Foam-Water Sprinkler and Foam-Water Spray Systems*.⁴⁰⁶ Further regulations are given carbon dioxide fire-extinguishing systems, the activation location of fire-extinguishing systems, ventilation control, signage and audible and visual signal of fire-extinguishing systems.⁴⁰⁷

Fire extinguishers and firefighting equipment are regulated in accordance with Sections 29 and 30, respectively, of the *Canada Oil and Gas Installations Regulations*.⁴⁰⁸

Automatic fire detection systems are regulated under Section 31 of the *Canada Oil and Gas Installations Regulations*. All offshore installations must be equipped with a gas detection system that can detect, in every part of the installation where hydrogen sulphide or any type of hydrocarbon gas could accumulate, the presence of those gases.⁴⁰⁹ All fire detection systems must be designed, installed and maintained in accordance with the NFPA 72E, *Standard on Automatic Fire Detectors*.⁴¹⁰ In addition, specific regulation are given on detection capability, location and audible and visual signals of automatic fire detection systems.⁴¹¹

Section 32 of the *Canada Oil and Gas Installations Regulations* addresses gas detection systems. Gas detectors must be installed and operated in accordance with Appendix C of API RP 14C, *Recommended Practice for Analysis, Design, Installation and Testing of Basic Surface Safety Systems for Offshore Production Platforms*; and Section 9.2 of API RP 14F, *Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platforms*.⁴¹² Furthermore, the automation of audible and visual alarm, redundancy, and location of gas detection systems are regulated.⁴¹³ Specific portable gas detectors are also required.⁴¹⁴

⁴⁰² Ibid., Section 27(1-10).

⁴⁰³ Ibid., Section 28(1-2).

⁴⁰⁴ Ibid., Section 28(3).

⁴⁰⁵ Ibid., Section 28(4).

⁴⁰⁶ Ibid., Section 28(5).

⁴⁰⁷ Ibid., Section 28(6-11).

⁴⁰⁸ Ibid., Sections 29 and 30.

⁴⁰⁹ Ibid., Section 32(1).

⁴¹⁰ Ibid., Section 31(3).

⁴¹¹ Ibid., Section 31(1-2, 4-7).

⁴¹² Ibid., Section 32(5).

⁴¹³ Ibid., Section 32(2,4).

All offshore installations require a fire and gas detection system, with indicator panels in the control stations and a unique and audible fire and gas alarm.⁴¹⁵ Alarm panels and signals must be installed and maintained as per NFPA 72, *Standard for the Installations, Maintenance, and Use of Protective Signaling Systems*.⁴¹⁶ In addition specific regulations exist for the activation locations of a fire and gas alarm system and the redundancy of power supplies to a fire and gas detection system.⁴¹⁷

5.3.2 United States

In the U.S. the Coast Guard regulates fire protection, detection and extinguishing along with structural fire protection for accommodations.⁴¹⁸ The BOEMRE regulates gas detection systems and components.⁴¹⁹ The BOEMRE does have a performance-based regulation, 30 CFR 250.107(b), that states offshore operators “must immediately control, remove or otherwise correct any hazardous oil and gas accumulation or other health, safety, or fire hazard.”⁴²⁰

BOEMRE also has a suite of prescriptive regulations formed largely from API recommended practices.

- a) Offshore production platforms must comply with the production safety requirements as well as the API Recommended Practice RP 14C, Recommended Practice for Analysis, Design, Installations, and Testing of Basic Surface Safety Systems for Offshore Production Platforms.⁴²¹
- b) Firefighting systems are required to adhere to API RP 14G, Fire Prevention and Control Open Type Offshore Production Platforms and approval from a District Manager.⁴²² Other specific regulations for firefighting systems are given in 30 CFR 250.803(b)(8), including for operations in subfreezing climates.
- c) Fire and gas detection systems are regulated under 30 CFR 250.803(b)(9).⁴²³ Specifically regulations on sensor locations, ventilation requirements, detection monitoring regimes, fuel odorants and automation are detailed.

⁴¹⁴ Ibid., Section 32(3).

⁴¹⁵ Ibid., Section 33(1).

⁴¹⁶ Ibid., Section 31(2)(c).

⁴¹⁷ Ibid., Section 33(2).

⁴¹⁸ Minerals Management Service and U.S. Coast Guard, *Memorandum of Agreement between the Minerals Management Service – U.S. Department of the Interior and the U.S. Coast Guard – U.S. Department of Homeland Security: Floating Offshore Facilities*, MMS/USCG MOA: OCS-04, February 28, 2008, <http://www.boemre.gov/regcompliance/MOU/PDFs/MOA-USCG04FloatingFacilities-Final.pdf>.

⁴¹⁹ Ibid.

⁴²⁰ “What must I do to protect health, safety, property, and the environment?,” U.S. Code of Federal Regulation Title 30, Pt. 250.107(b)

⁴²¹ “Subpart H – Oil and Gas Production Safety Systems,” U.S. Code of Federal Regulation Title 30, Pt. 250.802 and 250.803

⁴²² “Additional production system requirements,” U.S. Code of Federal Regulation Title 30, Pt. 250.803(b)(8)

⁴²³ Ibid., Pt. 250.803(b)(9)

- d) Fire and gas detection systems must also adhere to API RP 14G, Recommended Practice for Fire Prevention and Control on Fixed Open-type Offshore Production Platforms and either API RP 14F, Recommended Practice for Design and Installation of Electrical Systems for Offshore Production Platforms or API 14FZ, Recommended Practice for Design and Installation of Electrical Systems for Fixed and Floating Offshore Petroleum Facilities for Unclassified and Class I, Zone 0, Zone 1 and Zone 2 Locations.⁴²⁴

In an Application for Permit to Drill an operator must submit a plan that contains a “description of safety equipment, including gas detectors and fire-fighting equipment.”⁴²⁵ 30 CFR 250.802(e)(6) requires that the design and schematics of the installation and maintenance of all fire and gas detection systems include the following:

- a) “type, location and number of detection sensors;
- b) type and kind of alarms, including emergency equipment to be activated;
- c) method used for detection;
- d) a functional block diagram of the detection system, including the electric power supply.”⁴²⁶

The U.S. Coast Guard has specific regulations that pertain to the classification, location and number of portable and semi-portable fire extinguishers on offshore facilities (33 CFR 145.01/05/10).⁴²⁷

The Coast Guard has an extensive list of regulations for fire-extinguishing systems on mobile offshore drilling units (46 CFR 108.401–499).⁴²⁸ These regulations cover, for example, the operation of the fire main system, fire detection systems, piping, pressure release and water and foam extinguishing systems.

Comparison to the Canadian Arctic Offshore

In both the Canadian Arctic offshore and the U.S. there are many specific regulations on the components of a fire and gas system and both have performance-based regulations on the prevention of incidents. However, Canada’s National Energy Board does require a description of an overall fire and gas system, unlike the U.S. as required in the Application for Permit to Drill.

5.3.3 United Kingdom

In Schedule 2 and 3 of *The Offshore Installations (Safety Case) Regulations 2005*, Section 12 requires a description of how production and non-production installations intend to protect

⁴²⁴ Ibid., Pt.250.803(b)(8-9)

⁴²⁵ “What are the requirements for conducting a well test?,” U.S. Code of Federal Regulation Title 30, Pt. 250.460(a)(6)

⁴²⁶ “Design, installation, and operation of surface production-safety systems,” U.S. Code of Federal Regulation Title 30, Pt. 250.802(e)(6)

⁴²⁷ “Fire-Fighting Equipment,” U.S. Code of Federal Regulation Title 33, Pt. 145.01, 145.05, 145.10

⁴²⁸ “Fire Extinguishing Systems,” U.S. Code of Federal Regulation Title 46, Pt. 108.401-499

personnel from the hazards of explosion, fire, heat, smoke, toxic gas or fumes.⁴²⁹ Section 9 of *The Offshore Installations (Prevention of Fire and Explosion and Emergency Response) Regulation 1995* (PFEER) contains performance-based regulations on the prevention of fire and explosion.⁴³⁰ Similarly, Section 10 of PFEER states the required performance-based measures needed for the detection of incidents (including fire, accumulations of flammable or toxic gases and leakages of flammable liquids).⁴³¹ Section 12 (Control of emergencies) of PFEER requires the offshore installation to do the following:

- a) “Take appropriate measures with a view to limiting the extent of an emergency, including such measures to combat a fire and explosion; and
- b) Shall ensure that –
 - a. Where appropriate, those measures include provision for the remote operation of plant;
 - b. So far as is reasonably practicable, any arrangements made and plant provided pursuant to this regulations are capable of remaining effective in an emergency.”⁴³²

Section 13 of PFEER requires offshore installations to take the actions to mitigate the effects of fire and explosion.⁴³³ No specific regulations are given on the type of fire and gas systems needed or the specific equipment needed; rather, offshore installations are required to meet the goals described in the above regulations.

Comparison to the Canadian Arctic Offshore

There are no regulations in the U.K. and the Canadian Arctic offshore for on an overall fire and gas system. The U.K. also does not have any specific regulations on the components of a fire and gas system. Instead the U.K. has performance-based regulations on the mitigation of the effects from fire and explosion.

5.3.4 Greenland

The *Mineral Resources Act* does not specifically address fire and gas systems. Rather, Section 79(1) has the performance-based provision that health and safety risks must be “identified, assessed and reduced as much as practicably possible.”⁴³⁴ The Exploration Drilling Guidelines

⁴²⁹ Government of the U.K., *The Offshore Installations (Safety Case) Regulations 2005* Statutory Instrument 2006, No. 3117, Schedules 2 and 3, <http://www.legislation.gov.uk/ukSI/2005/3117/made>

⁴³⁰ Government of the U.K., *The Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995* Statutory Instrument 1995, No. 743, Section 9, <http://www.legislation.gov.uk/ukSI/1995/743/made>

⁴³¹ *Ibid.*, Section 10.

⁴³² *Ibid.*, Section 12.

⁴³³ *Ibid.*, Section 13.

⁴³⁴ Greenland Self Government, *Greenland Parliament Act of 7 December 2009 on Mineral Resources and Mineral Resource Activities (The Mineral Resources Act)*, http://www.bmp.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf

do not provide any guidance on fire and gas systems, although such requirements could be included in a licence or an approval letter.

Comparison to the Canadian Arctic Offshore

In both the Canadian Arctic offshore and Greenland there are no regulations on an overall fire and gas system; however, Greenland, similar to the U.K., also does not have any specific regulations on the components of a fire and gas system. Instead, Greenland has a general performance-based provision on the identification and reductions of health and safety risks. It is important to note that in both the licence and approval letter for offshore installations, specific provisions on fire and gas systems could be included.

5.3.5 Norway

Fire and gas detection systems are to be based on a “strategy” (Section 5) that ensures “quick and reliable detection of near-fires, fires and gas leaks” as required under Section 32 of the *Facilities Regulations*.⁴³⁵ Section 32 requires that fire and gas detection systems be redundant from the other management, control and safety systems.⁴³⁶ Automatic actions, like activation of the emergency shutdown system, firewater supply and fixed fire-fighting systems, must limit the consequences of a fire or gas leak.⁴³⁷ Placement of fire and gas detectors must be based on scenarios, simulations or tests.⁴³⁸

Section 35 of the *Facilities Regulation* stipulates that any facilities equipped with or attached to process facilities must have a gas release system. The regulation states that the gas release system will be designed so that the release of gas causes no harm to people or equipment, that depressurization can be triggered manually from the control room and that liquid separators will be prevented from overfilling.⁴³⁹

Firewater supply is regulated in Section 36 of the *Facilities Regulations*.⁴⁴⁰ This section outlines the requirements for various types of offshore facilities. The firewater system must be protected from pressure strokes and be independent from other systems. Fire pumps are required to automatically start if a fire or drop in the water main pressure is detected. Redundancy is required in the propulsion units and automatic disconnection functions are to be limited. Firewater piping must provide a sufficient amount of firewater to any area of the facility.

⁴³⁵ Petroleum Safety Authority Norway, *Regulations Relating to Design and Outfitting of Facilities, etc. in the Petroleum Activities (The Facilities Regulations)*, 2010, Sections 5 and 32, <http://www.ptil.no/facilities/category400.html>

⁴³⁶ Ibid., Section 32.

⁴³⁷ Petroleum Safety Authority Norway, *Guidelines Regarding the Facilities Regulations* 1996, Re: Section 32, <http://www.ptil.no/facilities/category405.html>.

⁴³⁸ Petroleum Safety Authority Norway, *Facilities Regulations*, Section 32.

⁴³⁹ Ibid., Section 35.

⁴⁴⁰ Ibid., Section 36.

Fixed fire-fighting systems are mandated, under Section 37 of the *Facilities Regulations*, to be installed in high-risk areas of an offshore facility.⁴⁴¹ They must be able to be automatically or manually activated with the intent of quick and efficient fire-fighting. Section 46 of the *Facilities Regulations* on manual fire-fighting and firefighters' equipment also have the performance-based requirement that the equipment be sufficient to be effective in combatting incipient fires and preventing the escalation of fires.⁴⁴²

Comparison to the Canadian Arctic Offshore

Similar to the regulations for the Canadian Arctic offshore, Norway has many specific regulations on the components of a fire and gas system and also has a performance-based requirement on the prevention of incidents. In addition, Norway also requires redundancy in an overall fire and gas system. Canada's National Energy Board, in contrast, requires redundancy in the specific components and sub-systems of a fire and gas system.

⁴⁴¹ Ibid., Section 37.

⁴⁴² Ibid., Section 46.

5.4 Hazardous area classification

5.4.1 Canadian Arctic Offshore

Under the *Canada Oil and Gas Installations Regulations*, hazardous areas with respect to hazards caused by combustible gases on an installation are classified in accordance with API RP 500 – Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities.⁴⁴³ These regulations also prohibit direct access or any opening between a non-hazardous area and a hazardous area and between a Class I, Division 2, hazardous area and a Class I, Division 1, hazardous area.⁴⁴⁴ Exceptions on access constraints to hazardous area classifications are described in Section 9(3-5) of the *Canada Oil and Gas Installations Regulations*. Furthermore, piping systems are precluded from direct communication between hazardous areas of different classifications and between hazardous and non-hazardous areas.⁴⁴⁵ Finally, Section 10 specifies the regulations for the ventilation of hazardous areas.⁴⁴⁶

5.4.2 United States

Hazardous area classification in the U.S. is regulated by both the USCG and the BOEMRE.⁴⁴⁷ The USCG regulates hazardous area classification under Title 46 (Shipping) of the CFR. Section 111.105-1 of 46 CFR on Shipping, hazardous locations for MODUs (not stationary installations) are defined using the National Fire Protection Association’s National Electrical Code 2002 and the International Electrotechnical Commission Code 60079-0 on Explosive Atmospheres.⁴⁴⁸ Classified Areas are defined under Section 108.170(a) of 46 CFR on Shipping as those areas “in which flammable hydrocarbon gas or vapours, resulting from the drilling operations, may be present in quantities sufficient to produce an explosive or ignitable mixture.”⁴⁴⁹ It is noted that location of classified areas will affect the design of machinery, electrical and ventilations systems. Similar to 46 CFR 111.105-1, this definition applies only to MODUs, not stationary

⁴⁴³ Government of Canada, *Canada Oil and Gas Installations Regulations* SOR/96-118, Section 2(2), <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-118/FullText.html>

⁴⁴⁴ Government of Canada, *Canada Oil and Gas Installations Regulations* SOR/96-118, Section 9(1), <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-118/FullText.html>

⁴⁴⁵ Government of Canada, *Canada Oil and Gas Installations Regulations* SOR/96-118, Section 9(6), <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-118/FullText.html>

⁴⁴⁶ Government of Canada, *Canada Oil and Gas Installations Regulations* SOR/96-118, Section 10, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-118/FullText.html>

⁴⁴⁷ Minerals Management Service and U.S. Coast Guard, *Memorandum of Agreement between the Minerals Management Service – U.S. Department of the Interior and the U.S. Coast Guard – U.S. Department of Homeland Security: Floating Offshore Facilities*, MMS/USCG MOA: OCS-04, February 28, 2008, <http://www.boemre.gov/regcompliance/MOU/PDFs/MOA-USCG04FloatingFacilities-Final.pdf>, (accessed April 9, 2011).

⁴⁴⁸ “Applicability; definition,” U.S. Code of Federal Regulations Title 46 Pt. 111.105-1

⁴⁴⁹ “Definitions,” U.S. Code of Federal Regulations Title 46, Pt. 108.170(a)

installations. There are also other classifications for Class I, Division 1 locations (Section 108.171), Class I Division 2 locations (Section 108.173) and contiguous locations (Section 108.175) that have lesser degrees of hazard than hazardous locations or classified areas.⁴⁵⁰

The BOEMRE regulates hazardous area classifications under Title 30 (Mineral Resource) of the CFR. Under 30 CFR 250.114, for all drilling facilities (both MODU and stationary drilling units), all areas must be classified according to API RP 500: Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Division 1 and Division 2 or API RP 505: Recommended Practice for Classification of Locations for Electrical Installations at Petroleum Facilities Classified as Class I, Zone 0, Zone 1, and Zone 2.⁴⁵¹

Comparison to the Canadian Arctic Offshore

Compared to the regulations for the Canadian Arctic offshore, the U.S. requires adherence to multiple standards on hazardous area classification.

5.4.3 United Kingdom

Under Sections 9(2)(b) and 21(a) of the PFEER Regulations, offshore installations are required to identify and designate “areas in which there is a risk of a flammable or explosive atmosphere occurring.”⁴⁵² However, this identification and designation of high-risk areas is not linked to any specific international standard on hazard area classification.

Comparison to the Canadian Arctic Offshore

Unlike the regulations for the Canadian Arctic offshore, the U.K. does not require adherence to any international standard on hazardous area classification. Although, offshore installations in the U.K. are required to generally identify and designate hazardous areas.

5.4.4 Greenland

The *Mineral Resources Act* does aim broadly “to ensure that activities under the Act are performed in a sound manner as regards safety, health, the environment, resource exploitation and social sustainability and appropriately and according to acknowledged best international practices under similar conditions.”⁴⁵³ It is considered an international best practice to follow the hazardous area classifications developed by NORSOK.⁴⁵⁴ However, neither the *Mineral Resources Act* nor the March 2010 Exploration Drilling Guidelines specifically address

⁴⁵⁰ “Material and Equipment,” U.S. Code of Federal Regulations Title 46, Pt. 108.171, 108.173, 108.175

⁴⁵¹ “Performance Standards,” U.S. Code of Federal Regulations Title 30, Pt. 250.114

⁴⁵² Government of U.K., *The Offshore Installations (Prevention of Fire and Explosion, and Emergency Response) Regulations 1995* SI 1995/743, Sections 9(2)(b) and 21(a), <http://www.legislation.gov.uk/ukSI/1995/743/made>

⁴⁵³ Greenland Self Government, *Greenland Parliament Act of 7 December 2009 on Mineral Resources and Mineral Resource Activities (the Mineral Resources Act)*, http://www.bmp.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf

⁴⁵⁴ Pers. Comm., Maja Sofie Burggaard, Special Advisor, Licence Department; Petroleum Section, Bureau of Minerals and Petroleum, Greenland Self-Government, May 5, 2011.

hazardous area classification, although such requirements could be included in a licence or an approval letter.

Comparison to the Canadian Arctic Offshore

Unlike Canada, Greenland does not have specific legislation or regulations addressing hazardous area classification, although such requirements could be included in a licence or an approval letter.

5.4.5 Norway

Section 5 of the *Facilities Regulations* requires that a “facility's areas shall be classified such that design and location of areas and equipment contribute to reduce the risk associated with fires and explosions.”⁴⁵⁵ While the Guidelines for the Facilities Regulations suggests using the International Electrotechnical Commission Code 61892-7: Mobile and fixed offshore units - Electrical installations – Part 7: Hazardous areas, they are not required to be used.⁴⁵⁶

Comparison to the Canadian Arctic Offshore

Unlike the regulations for the Canadian Arctic offshore and the U.S., but similar to the U.K., Norway does not require the adoption of any international standard on hazardous area classification. However, hazardous areas must be classified to reduce health and safety risks from fires and explosions.

⁴⁵⁵ Government of Norway, *Regulations Relating to Design and Outfitting of Facilities, etc. in the Petroleum Activities (the Facilities Regulations)*, 2010, Section 5, http://www.ptil.no/facilities/category400.html#_Toc280616913

⁴⁵⁶ Government of Norway, *Regulations Relating to Design and Outfitting of Facilities, etc. in the Petroleum Activities (the Facilities Regulations)*, 2010, Section 5, http://www.ptil.no/facilities/category400.html#_Toc280616913

5.5 Dynamic positioning system

5.5.1 Canadian Arctic Offshore

DPS for floating platforms is regulated in the Canadian Arctic offshore under Section 61 of the *Canada Oil and Gas Installations Regulations*. Specifically any DPS must be “designed, constructed and operated so that the failure of any main component with an annual failure rate of greater than 0.1, as determined from a detailed reliability analysis, cannot result in major damage to the platform, as determined from a failure modes and effects analysis of the main components, unless

- a) operational procedures for the dynamic positioning system avoid or take into account the effect of the failure of the single component; or
- b) every such component is routinely replaced so that the failure rate, as determined from the detailed reliability analysis, is no greater than 0.1 for the period between replacements.”⁴⁵⁷

In addition, all floating platforms must have an alert and response display system that shows the position of the platform with respect to the production or drill site and the amount of available power that will a) maintain the platform’s relative position and b) permit continued operation of the installation.⁴⁵⁸ Section 64(1)(t)(iii) requires that any floating platform using a DPS shall have in its operations manual “a description of the capability of that system in all operational and survival conditions within stated tolerances, when any single source of thrust has failed and full power is being supplied for all foreseeable operations and emergency services.”⁴⁵⁹

5.5.2 United States

The U.S. Coast Guard is the responsible agency for the regulation of dynamic position systems, as noted in a 2008 Memorandum of Agreement between the U.S. Coast Guard and the Mineral Management Service (now BOEMRE).⁴⁶⁰ However, neither the U.S. Coast Guard nor BOEMRE have published any regulations on DPS for floating platforms. In June 2010, the MMS published NTL 2010-N05 that stated in addition to the requirements under 30 CFR 250.104(a)(1), each

⁴⁵⁷ Government of Canada, *Canada Oil and Gas Installations Regulations* SOR/96-118, Section 61, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-118/FullText.html>

⁴⁵⁸ Government of Canada, *Canada Oil and Gas Installations Regulations* SOR/96-118, Section 61, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-118/FullText.html>

⁴⁵⁹ Government of Canada, *Canada Oil and Gas Installations Regulations* SOR/96-118, Section 64(1)(t)(iii), <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-118/FullText.html>

⁴⁶⁰ Minerals Management Service and U.S. Coast Guard, *Memorandum of Agreement between the Minerals Management Service – U.S. Department of the Interior and the U.S. Coast Guard – U.S. Department of Homeland Security: Floating Offshore Facilities*, MMS/USCG MOA: OCS-04, February 28, 2008, <http://www.boemre.gov/regcompliance/MOU/PDFs/MOA-USCG04FloatingFacilities-Final.pdf>, (accessed April 9, 2011).

operator must certify that they have reviewed their DPS that interfaces with the emergency well control operations.⁴⁶¹ In addition, NTL 2010-N05 required all dynamically positioned rigs to comply with secondary control system requirements immediately.⁴⁶² Secondary control systems can include a deadman or autoshear system as defined in API Spec 16D – Specifications for Control Systems for Drilling Well Control Equipment and Control Systems for Diverter Equipment. However, this NTL has been overturned by a District Judge and BOEMRE are still developing “Drilling Safety Rules” that may incorporate the new provisions on DPS.⁴⁶³ However, at the time of writing, the new rules were not yet formalized.⁴⁶⁴

Comparison to the Canadian Arctic Offshore

Unlike the Canadian Arctic offshore, the U.S. does not have any specific regulations on the performance, redundancy or operation on DPS.

5.5.3 United Kingdom

In the U.K., the *Offshore Installations (Safety Case) Regulations 2005* require the duty holder (i.e. the owner/operator of an offshore (fixed or mobile) installation) to prepare a safety case (Section 7 and 8).⁴⁶⁵ In this safety case, the duty holder must demonstrate that they have completed a suitable and sufficient risk assessment to demonstrate that risks are as low as reasonably practicable.⁴⁶⁶ While there are no regulations for DPS on offshore installations in the U.K., the requirement to conduct a safety case can mitigate some of the risks associated with a DPS. Guidelines for the Safety Case Regulations outline recommended practices involving DPS however adherence to these guidelines is not required.⁴⁶⁷

Comparison to the Canadian Arctic Offshore

Unlike the Canadian Arctic offshore, the U.K. does not have any specific regulations on the performance, redundancy or operation on DPS, other than the implicit consideration of DPS effectiveness in the safety case.

⁴⁶¹ Minerals Management Service, *NTL No. 2010-N05 National Notice to Lessees and Operators of Federal Oil and Gas Leases, Outer Continental Shelf (OCS): Increased Safety Measures for Energy Development on the OCS*, June 8, 2010, www.lrenergy.org/secure/process/DMSDownload.aspx?id=3836

⁴⁶² Minerals Management Service, *NTL No. 2010-N05 National Notice to Lessees and Operators of Federal Oil and Gas Leases, Outer Continental Shelf (OCS): Increased Safety Measures for Energy Development on the OCS*, June 8, 2010, www.lrenergy.org/secure/process/DMSDownload.aspx?id=3836

⁴⁶³ Beveridge and Diamond PC, *Strike Two – District Court Invalidates Offshore Drilling NTL 2010-N05*, October 22, 2010, <http://www.bdlaw.com/news-975.html> (accessed April 9, 2011).

⁴⁶⁴ Jennifer Dlouhy, “Government tried to clarify offshore drilling rules,” *Houston Chronicle* March 28, 2011, <http://www.chron.com/disp/story.mpl/business/7495247.html> (accessed April 9, 2011).

⁴⁶⁵ Government of U.K., *The Offshore Installations (Safety Case) Regulations 2005* SI 2006/3117, Sections 7 and 8, <http://www.legislation.gov.uk/uksi/2005/3117/made>

⁴⁶⁶ Government of U.K., *The Offshore Installations (Safety Case) Regulations 2005* SI 2006/3117, Schedule 1, Section 3, <http://www.legislation.gov.uk/uksi/2005/3117/made>

⁴⁶⁷ Government of U.K., *Guidance for the Topic Assessment of the Major Accident Hazard Aspects of Safety Cases*, Health and Safety Executive, Hazardous Installations Directorate, Offshore Division, <http://www.hse.gov.uk/offshore/gascet/gascet.pdf> (accessed 19 April 2011), Section 4.2HS2

5.5.4 Greenland

The *Mineral Resources Act* does not mention any regulations specifically addressing dynamic positioning systems. The March 2010 Exploration Drilling Guidelines also do not mention dynamic positioning systems. More generally, the *Mineral Resources Act* does aim broadly “to ensure that activities under the Act are performed in a sound manner as regards safety, health, the environment, resource exploitation and social sustainability and appropriately and according to acknowledged best international practices under similar conditions.”⁴⁶⁸ Generally, NORSOK standards are considered minimum requirements and are mandatory unless specific exemptions are approved.⁴⁶⁹

Comparison to the Canadian Arctic Offshore

Unlike the Canadian Arctic offshore, Greenland does not have any specific regulations on the performance, redundancy or operation on DPS, other than the more general safety provisions in the *Mineral Resources Act*. While specific provisions on DPS can be included in a licence or a drilling approval, it is unclear *a priori* the nature of those provisions.

5.5.5 Norway

Section 63 of the *Facilities Regulations* states that DPS “shall be designed so that the position can be maintained during defined failures and damage to the system, as well as during accidents. Components and equipment shall be designed so that the total system satisfies the requirements for a certain equipment class.”⁴⁷⁰ Section 90 of the *Activities Regulations*, which regulates positioning of maritime operations, broadly requires that “When carrying out maritime operations, the responsible party shall implement necessary measures so that those who participate in the operations, are not injured, and so that the probability of hazard and accident situations is reduced.”⁴⁷¹ This regulation applies to both vessels and facilities with a DPS. While not required, the technical provisions in the IMO MSC/Circular 645 standard are recommended.⁴⁷²

⁴⁶⁸ Greenland Self Government, *Greenland Parliament Act of 7 December 2009 on Mineral Resources and Mineral Resource Activities (the Mineral Resources Act)*, http://www.bmp.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf

⁴⁶⁹ Pers. Comm., Maja Sofie Burggaard, Special Advisor, Licence Department; Petroleum Section, Bureau of Minerals and Petroleum, Greenland Self-Government, May 5, 2011.

⁴⁷⁰ Government of Norway, *Regulations Relating to Design and Outfitting of Facilities, etc. in the Petroleum Activities (the Facilities Regulations)*, 2010, Section 63, http://www.ptil.no/facilities/category400.html#_Toc280616913

⁴⁷¹ Government of Norway, *Guidelines Regarding the Facilities Regulations* 1996, Re: Section 90, http://www.ptil.no/facilities/category405.html#_Toc280616810

⁴⁷² Government of Norway, *Guidelines Regarding the Facilities Regulations* 1996, Re: Section 90, http://www.ptil.no/facilities/category405.html#_Toc280616810

Comparison to the Canadian Arctic Offshore

Similar to the Canadian Arctic offshore, Norway has performance-based and redundancy requirements for DPS. In contrast to the Canadian Arctic offshore, no prescriptive regulations exist on DPS in Norway.

6. Requirements for Well Control

This chapter examines the requirements for well control for offshore drilling operations in the Canadian Arctic, the U.S., the U.K., Greenland, and Norway. Legislation and regulations relating to well control fall under these categories: well control equipment; equipment control systems, inspection and test requirements of pressure control equipment, and well barriers. A comparison of these requirements among all jurisdictions is made in Table 7 (below).

A loss of well control is a release of fluid and/or gas from the well, and can be caused by unexpected reservoir pressure, formation kick or a failure of surface equipment or procedures. Requirements for well control are an important element in all regulatory regimes under review in this report. There are similar performance-based requirements in the Canadian Arctic, the U.S., the U.K., Greenland, and Norway for operators to maintain control of an offshore well at all times. Regulatory provisions for well control vary widely, with some detailed requirements for types of equipment, and other broad performance-based requirement.

Well control equipment

Well control equipment generally includes a number of components:

- Blowout preventers (BOP) and the associated stack are designed to ensure pressure control of the well in case of a blowout. This stack includes various spools, adapters and piping outlets to permit the circulation of wellbore fluids.
- Diverters provide alternate paths for gas or gas-bearing mud returning to the rig from the well through side outlets to direct it away from the facility or personnel.
- A choke line directs fluid from an outlet on the BOP stack to the flaring system and a kill line directs fluid leads from an outlet on the BOP stack to the rig pump.
- A choke manifold is a set of high-pressure valves and associated piping to which well flow is directed and fluid pressure is controlled.
- Rams are used to close off the pipe, annulus, and well in case of emergency. There are four types of rams: pipe, blind, shear and blind-shear.
- Subsurface safety valves are intended to control well pressure in the tubing (producing conduits), and should close in a fail-safe position when excessive pressure is encountered in the wellbore.
- Surface safety valves are intended to control the well pressure at the surface. The system of spools, valves and assorted adapters that provide pressure control of a production well are commonly referred to as the “Christmas trees” because the piping and valve assembly is shaped like a tree.

Equipment control systems

Control systems refer to the location, type and strength of the equipment that would be used to control the well in case of an emergency. Redundancy in well control equipment is required from some jurisdictions to provide additional levels of control of the equipment. Some jurisdictions require that well control equipment be capable of being remotely operated or have additional automatic control options.

Inspection and test requirements of equipment

Inspection of equipment and testing is critical to ensure that pressure control equipment is in good working order and is capable of performing its function. Most jurisdictions have requirements for the conditions and frequency of testing and inspection, and require record-keeping of test and inspection results.

Well Barriers

The term "barrier" and the concept of a barrier are not used in all jurisdictions. In Canada's NEB regulations, a barrier is defined as any "fluid, plug or seal that prevents gas or oil or any other fluid from flowing unintentionally from a well or from a formation into another formation."⁴⁷³ Barriers can also have a broader meaning which includes operational and organizational measures which reduce the probability of harm.

⁴⁷³ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations* 2009, SOR/2009-315, Section 1, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

Table 7. Comparison of requirements for well control by jurisdiction to Canadian Arctic offshore

Regulatory Topic	Canadian Arctic offshore	United States	United Kingdom	Greenland	Norway
1. Requirements for well control	Operators are required to maintain full well control while drilling and operating.	Operators are required to take necessary precautions for well control at all times.	Operators are required to consider how to control well pressure.	Operators are required to take all necessary steps to prevent explosion and blowouts.	Operators are required to use equipment to ensure control of the well and maintain barrier integrity.
	Reliably operating well control equipment to prevent blow-outs is required.	Blowout preventers and associated equipment are required.	Blowout preventers are implicitly required as they are included in the definition of well.	Operators are required to submit information on well control equipment, but equipment is not specified.	Well intervention equipment is required in regulations. Guidelines recommend use of blowout preventers and shear rams.
	Regulations do not mention a diverter system.	A diverter system is required by regulation.	A diverter system is suggested in guidelines.	A diverter is not required in the regulations, although such requirements could be included in a licence or an approval letter.	A diverter is required in the regulations.
	A subsurface safety valve is required on every well capable of flow. Surface safety valves are implicitly required.	Surface and subsurface safety valves are required by legislation.	Surface and subsurface safety valves are suggested by guidelines.	Neither surface nor subsurface safety valves are specifically required in the regulations, although such requirements could be included in a licence or an approval letter.	Subsurface and surface safety valves are required.

Requirements for Well Control

	A policy requires capacity for a relief well in the same season as drilling for operations in the Beaufort Sea.	As part of application, operators must demonstrate financial capability and suggest time require to drill a relief well.	As part of emergency pollution plan, operators must detail plans for finances, timing, resources and design of a relief well.	A relief well contingency plan is required with the application.	Regulations require that a relief well be drilled in the event of loss of well control. Operators must demonstrate an action plan to drill the well.
2. Activation of well control systems	There are no specifications about the control system, but operators must submit information about equipment control systems to the regulator.	Control systems for blowout preventers must include redundant power supply and control centres. Subsea blowout preventers must have remote vehicle control capability.	There are no specific requirements for equipment control systems.	There are no specifications about the control system, but operators must submit information about equipment control systems to the regulator.	Blowout preventers must be able to be remotely activated from three locations, where at least one is located away from the well.
3. Inspection and test requirements of pressure control equipment	Equipment must be tested at the maximum load conditions that may be reasonably anticipated during any operation. Records of testing must be kept.	Blowout preventers systems must be tested every 14 days, at high and low pressure. They must be visually inspected every three days. Records of testing must be kept.	There are no set requirements for inspection, testing or record keeping. Operators are required to develop a verification scheme which requires that all critical components be kept in good working order.	Blowout preventers should be tested every 14 days. There are no requirements for inspection or record-keeping, although such requirements could be included in a licence or an approval letter.	Regulations require a maintenance and monitoring program to be developed based on importance of the equipment. Guidelines suggest testing blowout preventers every 14 days.
4. Well Barriers	At least two independent and tested well barriers must be in place	At least two barriers (at least one mechanical) are required across the	There are no references to the term or concept of barriers.	Barriers are not required, and mentioned only as an option for well control	Barriers are required for well control. Barrier testing is required, and barriers

Requirements for Well Control

	during all well operations after setting the surface casing.	flow path during well completion.		when BOPs are undergoing maintenance, although such requirements could be included in a licence or an approval letter.	should be selected based on the ability to reduce risk.
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6.1 Well control equipment

6.1.1 Canadian Arctic Offshore

Canada's National Energy Board has performance-based regulations for well control. Section 19(f) of the *Canada Oil and Gas Drilling and Production Regulations* requires operators to conduct drilling and well operations in a manner that maintains full control of the well at all times.⁴⁷⁴

Section 35 requires the operator to ensure that adequate procedures, materials and equipment are in place and utilized to “minimize the risk of loss of well control.”⁴⁷⁵ If there is a loss of control, all other wells in the installation must be shut down until the out-of-control well is secured⁴⁷⁶ and operators are required to take “all action necessary to rectify the situation is taken without delay, despite any condition to the contrary in the well approval.”⁴⁷⁷

The operator must ensure that reliable equipment for well control is installed and operated during all well operations, to control kicks, prevent blow-outs and safely carry out all well activities.⁴⁷⁸ Well control equipment in this instance is not defined, but could include BOPs, diverters and wellhead equipment. During drilling, two independently- tested barriers are required, of which a BOP could be one of these.⁴⁷⁹ During formation flow testing, a floating drilling unit must have a subsea test tree that includes a valve that can be operated from the surface and can be automatically closed in the event of a loss of well control (a BOP), and a system that allows the test string to be hydraulically or mechanically disconnected within or below the blowout preventers.⁴⁸⁰

A fail-safe subsurface safety valve is required on every well capable of flow, and this valve must be designed, installed, operated and tested to prevent uncontrolled well flow.⁴⁸¹ In permafrost regions, the valve must be installed in the tubing below the base of the permafrost.⁴⁸² The presence of wellhead valve or Christmas tree equipment is not explicitly mandated, but section 48 of the *Canada Oil and Gas Drilling and Production Regulations* does require that this equipment be designed to operate safely and efficiently under the maximum load conditions

⁴⁷⁴ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 19(f), <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

⁴⁷⁵ Ibid., Section 35.

⁴⁷⁶ Ibid., Section 19(g).

⁴⁷⁷ Ibid., Section 38.

⁴⁷⁸ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 36, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

⁴⁷⁹ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 36, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>

⁴⁸⁰ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 34 (a,b), <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

⁴⁸¹ Ibid., Section 47(1).

⁴⁸² Ibid., Section 47(2).

anticipated during the life of the well,⁴⁸³ and section 46 (c and d) require safe operations during testing and production.⁴⁸⁴

The NEB requires operators to submit a contingency plan that would contain details of their procedures to regain control of a lost well, including plans to drill a relief well. The NEB, as a policy, prohibits drilling into potential hydrocarbon-bearing zones without the ability to drill a relief well in the same season in the Beaufort Sea.⁴⁸⁵ To demonstrate the ability to drill a relief well, operators are required to show that a viable and suitable relief well drilling system would be available.⁴⁸⁶

6.1.2 United States

The U.S. has performance-based regulations for well control but prescriptive measures for BOP installations.

30 CFR 205.401 requires the owner/ designated operator to take necessary precautions to keep the well under control at all times by using 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.⁴⁸⁷

All BOP systems (which include the BOP stack and associated equipment) must be designed, installed, maintained, tested, and used to ensure well control.⁴⁸⁸ Designs of BOPs must be verified by an independent third party to ensure that that blind-shear rams installed in the BOP stack are capable of shearing any drill pipe in the hole under maximum anticipated surface pressure, that the BOP system is specifically designed to operate in the specific well and conditions where it will be used, and that it is free from damage from any previous use.⁴⁸⁹

30 CFR 250.440 requires that the working-pressure rating of each BOP component must exceed maximum anticipated surface pressures.⁴⁹⁰ All BOP systems must include a back-up

⁴⁸³ Ibid., Section 48.

⁴⁸⁴ Ibid., Section 46.

⁴⁸⁵ Beaufort Sea Steering Committee, *Report to the Minister of Indian Affairs and Northern Development Regarding Issues Arising from the Environmental Impact Review Board Reviews of the Isserk and Kulluk Drilling Program Applications*, Canada Oil and Gas Lands Administration 1991, Vol. 1, Section 3.2, <http://pubs.aina.ucalgary.ca/misc/33778.pdf>

⁴⁸⁶ Beaufort Sea Steering Committee, *Report to the Minister of Indian Affairs and Northern Development Regarding Issues Arising from the Environmental Impact Review Board Reviews of the Isserk and Kulluk Drilling Program Applications*, Canada Oil and Gas Lands Administration 1991, Vol. 1, Section 3.2, Recommendations, <http://pubs.aina.ucalgary.ca/misc/33778.pdf>

⁴⁸⁷ “What must I do to keep wells under control?” U.S. Code of Federal Regulations Title 30, Pt. 205.401.

⁴⁸⁸ “What are the general requirements for BOP systems and system components?,” U.S. Code of Federal Regulations Title 30, Pt. 250.440.

⁴⁸⁹ “What must I include in the diverter and BOP descriptions?,” U.S. Code of Federal Regulations Title 30, Pt. 250.416.

⁴⁹⁰ “What are the general requirements for BOP systems and system components?,” U.S. Code of Federal Regulations Title 30, Pt. 250.440.

accumulator, at least two BOP control stations, choke and kill lines with two valves which can be remotely operated and outlets on the BOP stack to hold these lines⁴⁹¹ and a choke manifold.⁴⁹²

Surface and subsea BOP systems have slightly different requirements:

A surface BOP must have an accumulator system that provides more than adequate volume of fluid capacity necessary to close and hold closed all BOP components, be controlled by at least four remote-controlled, hydraulically operated BOPs with blind-shear rams that are capable of shearing the drill pipe that is in the hole, and be installed before drilling below surface casing.⁴⁹³

Subsea BOPs must meet additional requirements including:⁴⁹⁴

- An accumulator⁴⁹⁵ system that meets or exceeds API RP 53,⁴⁹⁶
- A remotely operated vehicle (ROV) intervention capability (and a crew trained in ROV operations must be continually based on a floating drilling rig),
- Autoshear and deadman systems for dynamically positioned rigs,
- Operational or physical barriers on BOP control panels,
- Development and use of a management system for operating the BOP system, including the prevention of accidental or unplanned disconnects,
- For operations with 4 or more subsea BOPs, one BOP must be an annular, two must be equipped with pipe rams, and one must be equipped with blind-shear rams.

The regulations require the use of BOPs during drilling, completion operations⁴⁹⁷ and workover operations.⁴⁹⁸

30 CFR 250.430 requires the use of a diverter system (consisting of a diverter sealing element, diverter lines, and control systems) for drilling a conductor or surface hole. The diverter system must be designed, installed, used, maintained, and tested to ensure proper diversion of gases, water, drilling fluid, and other materials away from facilities and personnel.⁴⁹⁹

Subsurface and subsurface safety valves are required through the incorporation of API Spec 14A⁵⁰⁰ into 30 CFR 250.806.

⁴⁹¹ “What associated systems and related equipment must all BOP systems include?” U.S. Code of Federal Regulations Title 30, Pt. 250.443.

⁴⁹² “What are the choke manifold requirements?” U.S. Code of Federal Regulations Title 30, Pt. 250.444.

⁴⁹³ “What are the requirements for a surface BOP stack?” U.S. Code of Federal Regulations Title 30, Pt. 250.441.

⁴⁹⁴ “What are the requirements for a subsea BOP system?” U.S. Code of Federal Regulations Title 30, Pt. 250.442.

⁴⁹⁵ An accumulator stores hydraulic pressure in order to control the blowout preventer.

⁴⁹⁶ API RP 53 *Recommended Practices for Blowout Prevention Equipment Systems for Drilling Wells- Accumulator Volumetric Capacity*. Incorporated in U.S. Code of Federal Regulations Title 30, Pt. 250.198.

⁴⁹⁷ “What are the general requirements for BOP systems and system components?” U.S. Code of Federal Regulations Title 30, Pt. 250.440.

⁴⁹⁸ Workover operations are remedial activities to maintain the well productions rate. “Blowout prevention equipment, Blowout preventer system testing, records, and drills, What are my BOP inspection and maintenance requirements?” U.S. Code of Federal Regulations Title 30, Pts. 250.615-250.617.

⁴⁹⁹ “When must I install a diverter system?” U.S. Code of Federal Regulations Title 30, Pt. 250.430.

⁵⁰⁰ ANSI/API Specification 14A, *Specification for Subsurface Safety Valve Equipment*, 2005.

As part of the submission for an exploration plan, operators are required to provide a statement that they are financially capable of drilling a relief well, to discuss the availability of a rig to drill a relief well in the event of a spill, and to estimate the time it would take to drill a relief well, but relief wells are not explicitly required as part of well control.⁵⁰¹

Comparison to the Canadian Arctic Offshore

As compared to the Canadian Arctic offshore, the U.S. has similar performance-based regulations for well control, but unlike in the Canadian Arctic offshore, has prescriptive regulations for the type, placement, and use of well control equipment. Similar to the Canadian Arctic offshore, the U.S. requires surface and subsurface safety valves, and operators must demonstrate their capacity to drill a relief well.

6.1.3 United Kingdom

In the *Offshore Installations and Wells (Design and Construction, etc.) Regulations*, the definition of “well” includes “any device on it for containing the pressure in it”⁵⁰² and thus a well includes pressure-containing equipment on top of the well such as BOPs or Christmas trees, but excludes well control equipment downstream that can be isolated from the well by valves.⁵⁰³ Regulation 17 requires that the well-operator/duty holder ensure that suitable well control equipment is provided and deployed to protect against blowouts before an operation in relation to a well (including drilling) is begun.⁵⁰⁴ The guidance document for these regulations recommends that well control equipment include equipment whose primary purpose is to prevent, control or divert the flow of fluids from the well. As such, the definition of well control equipment includes BOPs, downhole preventers (subsurface safety valves), Christmas trees (surface safety valve), diverters and a number of other pieces of equipment.⁵⁰⁵

The *Offshore Installations (Safety Case) Regulations 2005* also require the operator to detail how they will keep control of the pressure in the well.⁵⁰⁶

Relief wells are not required in the regulations, but the guidelines for preparing Oil Pollution Emergency Plans specify that operators must identify potential action in a “worst case scenario” which is a blowout where all containment barriers have failed, and a relief well is normally

⁵⁰¹ “What general information must accompany the EP?,” U.S. Code of Federal Regulations Title 30, Pt. 250.213.

⁵⁰² Government of the U.K., *The Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996* Statutory Instrument 1996, No. 913, <http://www.legislation.gov.uk/uksi/1996/913/contents/made>.

⁵⁰³ U.K. Health and Safety Executive, *A Guide to the Well Aspects of the Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996*, 2008, <http://www.hse.gov.uk/pubns/priced/184.pdf>

⁵⁰⁴ Government of the U.K., *The Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996*, Regulation 17.

⁵⁰⁵ U.K. Health and Safety Executive, *A Guide to the Well Aspects of the Offshore Installations and Wells (Design and Construction, etc.) Regulations 1996*, Section 34.

⁵⁰⁶ Government of the U.K., *The Offshore Installations (Safety Case) Regulations 2005*, Statutory Instrument 2005, No. 3117, Schedule 2, <http://www.legislation.gov.uk/uksi/2005/3117/made>.

required.⁵⁰⁷ Plans must demonstrate that a relief well could be drilled in a timely manner by confirming that the operators have adequate financial resources to complete a relief well. Operators must consider the design of a relief well, estimate the time needed to complete relief well drilling, discuss how a secondary drilling rig will be obtained, and how the relief well will be managed.⁵⁰⁸

Comparison to the Canadian Arctic Offshore

The regulations in the U.K. and the Canadian Arctic offshore differ in that a BOP is considered part of the well in the U.K. (whereas in the Canadian Arctic it is considered part of the well control equipment), and other well control equipment (including safety valves and diverters) is recommended in guidelines. Similar to the Canadian Arctic offshore, operators must demonstrate their capacity to drill a relief well.

6.1.4 Greenland

Section 5.1 of the March 2010 Exploration Drilling Guidelines requires “all necessary steps shall be taken to prevent explosion and blowouts” during drilling operations.⁵⁰⁹ A procedure for kick control is required, and operators must outline how BOPs and other equipment will be used under emergency or kick situations.⁵¹⁰

Section 4.16 requires a list of well control measures, including specifications on the available blowout prevention equipment such as manufacturer, size, working pressure, and arrangement, to be submitted when an operator applies for a drilling program.

A diverter system is not explicitly required. There are no specific requirements for safety valves.

There is no specific requirement for relief wells in Greenland legislation but the guidelines require that a Relief Well Contingency Plan be submitted as part of the application for a licence.⁵¹¹

Additional requirements for well control can be specified in a licence or an approval letter from the BMP.

Comparison to the Canadian Arctic Offshore

Similar to the Canadian Arctic offshore, Greenland’s guidelines require that operators submit information about well control equipment as part of the application, and the guidelines do not specify what type of well control equipment should be used. Greenland differs from the

⁵⁰⁷ U.K. Department of Energy and Climate Change, *Oil Pollution Emergency Plan Requirements*, 2009, Section 4.2, https://www.og.decc.gov.uk/environment/OPEP_Guidance.doc.

⁵⁰⁸ U.K. Department of Energy and Climate Change, *Revised Guidance Relating To Environmental Submissions*, http://www.ukooaenvironmentallegislation.co.uk/Contents/Additional_Files/OPEPs/Letter_to_Industry_pdf_copy.pdf.

⁵⁰⁹ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, Section 5.1, http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf.

⁵¹⁰ Ibid., Section 4.16 (b).

⁵¹¹ Ibid., Appendix B.

Canadian Arctic offshore in that it does not require safety valves. Similar to the Canadian Arctic offshore, there is a requirement to show capacity to drill a relief well as part of the application for a well.

6.1.5 Norway

Norway has some prescriptive regulations regarding use of well-control equipment, and performance-based requirements for the capability of that equipment to perform its intended function.

Section 49 of the *Facilities Regulations* states that well control equipment shall be designed and capable of activation to ensure control of the well, and that well control equipment shall be designed and capable of activation such that it ensures barrier integrity.⁵¹² Section 53 of the *Facilities Regulations* requires that equipment in the well and on the surface shall be designed to safeguard controlled flow rates.⁵¹³

Section 49 of the *Facilities Regulations* requires BOPs, diverters and a remote-controlled ram.⁵¹⁴ The guidelines recommend NORSOK D-010 and NORSOK D-001 standards be met⁵¹⁵ in order to fulfil these requirements. Another standard (DNV-OS-E101) is mentioned in the guidelines as an alternative to NORSOK D-001. This second standard requires two shear rams, as opposed to only one required in NORSOK D-001.⁵¹⁶

Subsurface safety valves are required for the flow line and annulus (the space between the drill pipe and the sides of the well).⁵¹⁷ Surface valves are also required.⁵¹⁸

Section 86 of the *Activities Regulations* states that a relief well shall be used in the event of loss of well control, and that an action plan to drill this relief well shall be prepared.⁵¹⁹ Guidelines for this section recommend that the action plan should contain a description of mobilization and organization of personnel and facilities, with reference to the NORSOK D-010 standard.⁵²⁰

⁵¹² Petroleum Safety Authority Norway, , *Regulations Relating to Design and Outfitting of Facilities, etc. in the Petroleum Activities (The Facilities Regulations)*, 2010, Section 49, <http://www.ptil.no/facilities/category400.html>.

⁵¹³ Ibid., Section 53.

⁵¹⁴ Ibid., Section 49.

⁵¹⁵ Standards Norway, *NORSOK Standard D-010: Well Integrity in Drilling and Well Operations*, 2004, <http://www.standard.no/PageFiles/1315/D-010r3.pdf>; Norwegian Technology Standards Institution, *NORSOK Standard D-001: Drilling Facilities*, 1998, Section 5.7-5.9, <http://www.standard.no/PageFiles/1318/D-001.pdf>.

⁵¹⁶ Det Norske Veritas, *Offshore Standard DNV-OS-E101 Drilling Plant*, 2009, <http://exchange.dnv.com/publishing/Codes/download.asp?url=2009-10/os-e101.pdf>.

⁵¹⁷ Petroleum Safety Authority Norway, *Facilities Regulations*, Section 53.

⁵¹⁸ Ibid., Section 33.

⁵¹⁹ Petroleum Safety Authority Norway, *Regulations Relating to Conducting Petroleum Activities (The Activities Regulations)*, 2008, Section 86, <http://www.ptil.no/activities/category399.html>.

⁵²⁰ Standards Norway, *NORSOK Standard D-010: Well Integrity in Drilling and Well Operations*.

Comparison to the Canadian Arctic Offshore

In comparison to the Canadian Arctic offshore, Norway has similar performance requirements for well control equipment. Like the Canadian Arctic offshore, safety valves are required in the regulations. Unlike the Canadian Arctic offshore, diverters and shear rams, and a relief well plan, are required in the regulations.

6.2 Activation of well control systems

6.2.1 Canadian Arctic Offshore

Operators are required to submit the details of well control equipment systems to the NEB as part of the application for well authorization, but the regulations do not stipulate where or how well control equipment can be activated. Operators must meet the requirements of section 35 of the *Canada Oil and Gas Drilling and Production Regulations*, which requires that procedures, materials and equipment be in place and utilized to minimize the risk of loss of well control.

6.2.2 United States

All BOP systems must include: a back-up accumulator, at least two BOP control stations, choke and kill lines with two valves which can be remotely operated, and outlets on the BOP stack to hold these lines.⁵²¹ Subsea BOPs must have a dual pod control system, ROV intervention capability, autoshear and deadman systems,⁵²² accumulator and automatic back up for the primary accumulator charging systems, at least two BOP control systems, one of which must be away from the drilling floor.⁵²³

Comparison to the Canadian Arctic Offshore

Unlike in the Canadian Arctic offshore, U.S. regulations stipulate how and where controls systems for equipment can be activated.

6.2.3 United Kingdom

The *Offshore Installations and Wells (Design and Construction etc.) Regulations 1996* require that well control equipment be deployed when conditions require,⁵²⁴ and that the well be operated so that risks to the health and safety of persons are as low as is reasonably practicable.⁵²⁵

⁵²¹ “What associated systems and related equipment must all BOP systems include?” U.S. Code of Federal Regulations Title 30, Pt. 250.443.

⁵²² Deadman and autoshear systems both provide independent backup BOP control. “What are the requirements for a subsea BOP system?” U.S. Code of Federal Regulations Title 30, Pt. 250.442.

⁵²³ “What associated systems and related equipment must all BOP systems include?” U.S. Code of Federal Regulations Title 30, Pt. 250.443.

⁵²⁴ Government of the U.K., *The Offshore Installations and Wells (Design and Construction etc.) Regulations 1996*, Statutory Instrument 1996, No. 913, Section 17(2), <http://www.legislation.gov.uk/ukxi/1996/913/contents/made>.

⁵²⁵ *Ibid.*, Section 13.

Comparison to the Canadian Arctic Offshore

Similar to the Canadian Arctic offshore, the U.K. has performance-based requirements for use of well equipment to ensure safety.

6.2.4 Greenland

Greenland's guidelines require that information regarding the BOP control system⁵²⁶ as well as information on how BOPs and equipment are expected to be used under emergency conditions⁵²⁷ be submitted as part of the application for a licence, but there are no specifications about what type of control system or where equipment can be activated. However, additional requirements for equipment control systems responsibilities can be specified in a licence or an approval letter from the BMP.

Comparison to the Canadian Arctic Offshore

Greenland's requirements are similar to the Canadian Arctic offshore in that information about control systems must be submitted to the regulator, but location or type of control system is not specified.

6.2.5 Norway

Section 49 of the *Facilities Regulations* requires that the blind shear ram must be capable of being remotely-controlled.⁵²⁸ The guidelines for this section recommend that in order to meet the requirement of well control, that the main unit of the activation system should be located at a safe distance from the well, that the BOP can be activated from at least three locations (one in a safe area), and that in the event of well intervention, it should be possible to activate pressure control equipment from at least two locations on the facility (one in a safe area).⁵²⁹ The pressure control equipment used in well interventions is required to have remote-controlled valves with mechanical locking mechanisms in the closed position.⁵³⁰

This section also requires that floating facilities have an alternative activation system of the BOP⁵³¹ and a system that ensures release of the riser before a critical angle occurs.⁵³²

⁵²⁶ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, Section 4.16 (a), http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf

⁵²⁷ Ibid., Section 4.16 (b)

⁵²⁸ Petroleum Safety Authority Norway, *Regulations Relating to design and Outfitting of Facilities, etc. in the Petroleum Activities (The Facilities Regulations)*, 2010, Section 49, <http://www.ptil.no/facilities/category400.html>.

⁵²⁹ Ibid.

⁵³⁰ Ibid.

⁵³¹ Petroleum Safety Authority Norway, *Guidelines Regarding The Facilities Regulations*, 2010, Section 49, <http://www.ptil.no/facilities/category405.html#p19>.

⁵³² Ibid., Section 50.

Comparison to the Canadian Arctic Offshore

Norway's regulations differ from the Canadian Arctic offshore in that requirements for location and remote-control capability of well control systems are explicitly outlined in the regulations.

6.3 Inspection, test and maintenance requirements of pressure control equipment

6.3.1 Canadian Arctic Offshore

Canada's National Energy Board regulations requires that all equipment (including pressure control equipment) be tested under the maximum load conditions that are reasonably anticipated during any operation⁵³³ and those records of all testing are kept.⁵³⁴ Regulations require that all equipment be kept in an operable condition⁵³⁵ and that processes for ensuring and maintaining the integrity of equipment must be outlined in the management system.⁵³⁶

6.3.2 United States

The regulations 30 CFR 250.446 require that all BOP systems must be maintained and inspected according to API RP 53.⁵³⁷ The BOP system must be pressure-tested every 14 days or, when drilling, before each new string of casing or liner.⁵³⁸ Tests must take place at low and high pressures, and last for at least five minutes.⁵³⁹ Records of time, date, and results of all pressure tests, actuations, and inspections must be kept for the duration of drilling.⁵⁴⁰

Surface BOPs must be inspected on a daily basis⁵⁴¹ and tested with water.⁵⁴²

Subsea BOPs must be inspected every three days.⁵⁴³ Subsea BOPs must be stump-tested, and the functionality of ROVs, autoshear and deadman systems must be tested regularly.⁵⁴⁴

⁵³³ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 25(a), <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

⁵³⁴ Ibid., Section 25(c).

⁵³⁵ Ibid., Section 19(i).

⁵³⁶ Ibid., Section 5(e).

⁵³⁷ American Petroleum Institute, *Recommended Practices for Blowout Prevention Equipment Systems for Drilling Wells*. Incorporated in U.S. Code Of Federal Regulations Title 30, Pt. 250.198.

⁵³⁸ "When must I pressure test the BOP system?," U.S. Code Of Federal Regulations Title 30, Pt. 250.447.

⁵³⁹ "What are the BOP pressure tests requirements?," U.S. Code Of Federal Regulations Title 30, Pt. 250.448.

⁵⁴⁰ "What are the recordkeeping requirements for BOP tests?," U.S. Code Of Federal Regulations Title 30, Pt. 250.450.

⁵⁴¹ "What are the BOP maintenance and inspection requirements?," U.S. Code of Federal Regulations Title 30, Pt. 250.446.

⁵⁴² "What additional BOP testing requirements must I meet?," U.S. Code of Federal Regulations Title 30, Pt. 250.449.

⁵⁴³ "What are the BOP maintenance and inspection requirements?," U.S. Code of Federal Regulations Title 30, Pt. 250.446.

⁵⁴⁴ "What additional BOP testing requirements must I meet?," U.S. Code of Federal Regulations Title 30, Pt. 250.449.

Diverter systems must be activated, and vent lines must be flow tested at least once every 24-hour period after the initial test. Diverter sealing elements and diverter valves must be tested to a minimum of 200 psi after assembling well-control or pressure-control equipment on the conductor casing, and once the diverter is installed, it must be tested every seven days.⁵⁴⁵ For floating drilling operations with a subsea BOP stack, the diverter must be actuated every seven days, and testing must be alternated between control stations. Records of time, date, and results of all diverter pressure tests, actuations, and inspections must be kept for the duration of drilling.⁵⁴⁶

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 three to five years.

Comparison to the Canadian Arctic Offshore

As compared to the Canadian Arctic offshore, the U.S. regulations are much more specific about frequency and nature of testing. The U.S. incorporates a standard in the regulation for maintenance, whereas the Canada’s National Energy Board maintenance requirements fall under the management system. Record-keeping is required in both jurisdictions.

6.3.3 United Kingdom

There are no prescriptive regulations for the frequency and nature of testing equipment, or keeping of records. Instead operators are required to develop a verification scheme which requires that ‘safety critical elements’ must be ‘suitable.’⁵⁴⁷ ‘Suitable’ is defined in the guidelines as “being appropriate for the intended use, dependable and effective when required, and able to perform as intended.”⁵⁴⁸ ‘Safety critical elements’ are any parts of the installations where failure of these parts could cause or contribute substantially to a major accident.⁵⁴⁹ The scheme must cover the examination and testing of safety critical elements by independent persons, and duty holders are required to take appropriate action in the light of the findings of the independent person.⁵⁵⁰

Comparison to the Canadian Arctic Offshore

Similar to the Canadian Arctic offshore, the U.K. has performance-based requirements for equipment maintenance and does not specify the frequency of testing. There are no specific requirements for record-keeping.

⁵⁴⁵ “What are the diverter actuation and testing requirements?,” U.S. Code Of Federal Regulations Title 30, Pt. 250.433.

⁵⁴⁶ “What are the recordkeeping requirements for diverter actuations and tests?,” U.S. Code of Federal Regulations Title 30, Pt. 250.434.

⁵⁴⁷ Government of the U.K., *The Offshore Installations (Safety Case) Regulations 2005*, Statutory Instrument 2005, No. 3117, Section 5(a), <http://www.legislation.gov.uk/ukxi/2005/3117/made>.

⁵⁴⁸ U.K. Health and Safety Executive, *A Guide to the Offshore Installations (Safety Case) Regulations 2005*, 2006, <http://www.hse.gov.uk/pubns/priced/130.pdf>.

⁵⁴⁹ Government of the U.K., *The Offshore Installations (Safety Case) Regulations 2005*, Section 2.

⁵⁵⁰ *Ibid.*, Section 6(a).

6.3.4 Greenland

Greenland requires that BOPs, diverter systems and related equipment must be tested before drilling.⁵⁵¹ Guidelines state that pressure or operational testing of the BOPs and the associated pressure control equipment shall be carried out every 14 days, after disassembly, and ‘when drilling operations or other conditions make it reasonable.’⁵⁵² There are no specific requirements for the nature of testing BOPs or for record-keeping.⁵⁵³ Additional requirements for inspection, test and maintenance requirements of pressure control systems can be specified in a licence or an approval letter from the Bureau of Minerals and Petroleum.

Comparison to the Canadian Arctic Offshore

Unlike the Canadian Arctic offshore, Greenland’s guidelines specify the frequency of testing, but do not specify requirements for record-keeping.

6.3.5 Norway

A maintenance program is required⁵⁵⁴ that must include monitoring of the performance and technical condition of equipment, and plans to repair any failures.⁵⁵⁵ A number of standards are recommended in the guidelines to help shape the components of the maintenance program.⁵⁵⁶

Regulations require that the BOP and associated pressure control equipment be pressure tested and function tested. Guidelines recommend pressure testing every 14 days, and function testing every seven days.⁵⁵⁷ Moreover, regulations state that the BOP and associated equipment should be completely overhauled and recertified every five years.⁵⁵⁸

Comparison to the Canadian Arctic Offshore

Norway’s regulations require a maintenance program, whereas in the Canadian Arctic offshore this is considered under the management system. Guidelines specify the frequency of testing and regulations require recertification, which differs from the Canadian Arctic offshore requirements.

⁵⁵¹ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, Section 5.1, http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf

⁵⁵² Ibid., Section 5.4.

⁵⁵³ Ibid., Section 4.16 (d).

⁵⁵⁴ Petroleum Safety Authority Norway, *Regulations Relating to Conducting Petroleum Activities (The Activities Regulations)*, 2008, Section 44, <http://www.ptil.no/activities/category399.html>.

⁵⁵⁵ Ibid., Section 47.

⁵⁵⁶ Petroleum Safety Authority Norway, *Guidelines Regarding The Activities Regulations*, Re Section 47, <http://www.ptil.no/activities/category404.html>.

⁵⁵⁷ Ibid., Re Section 48.

⁵⁵⁸ Petroleum Safety Authority Norway, *Activities Regulations*, Section 51.

6.4 Well barriers

6.4.1 Canadian Arctic Offshore

Canada's National Energy Board requires that at least two independent and tested well barriers are in place during all well operations after setting the surface casing. If a barrier fails, then no activity, other than those intended to restore or replace the barrier, can take place in the well. During drilling, one of the two barriers must be maintained in the drilling fluid column except when the well is underbalanced.⁵⁵⁹

6.4.2 United States

New regulations developed since April 2010 require that two independent tested barriers, including one mechanical barrier, to be present across each flow path during well completion activities as part of the casing and cementing requirements.⁵⁶⁰ The new regulations also require identification of mechanical barriers and cementing practices for each casing string as part of an application for a drilling permit.⁵⁶¹

Comparison to the Canadian Arctic Offshore

The new U.S. regulations are very similar to regulations in the Canadian Arctic offshore in that two barriers are required. Canada's Arctic offshore regulations require barriers during all well operations while the U.S. specifies that they are required during well completion activities.

6.4.3 United Kingdom

No reference to the concept of barriers or prescriptive regulations on barriers currently exist.

Comparison to the Canadian Arctic Offshore

In contrast to the Canadian Arctic offshore, the U.K. does not require barriers during well operations.

6.4.4 Greenland

No regulations or guidelines on well barriers currently exist. The use of barriers is mentioned in the guidelines only as a requirement to control the well when BOPs undergo maintenance.⁵⁶²

⁵⁵⁹ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations* 2009, SOR/2009-315, Section 36(2-4), <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

⁵⁶⁰ "What well casing and cementing requirements must I meet?" U.S. Code of Federal Regulations Title 30, Pt. 250.420(a)(6) (part of the new "interim final rule" (75 FR 63346)).

⁵⁶¹ "What must my casing and cementing programs include?" U.S. Code Of Federal Regulations Title 30, Pt. 250.415(f) (part of the new "interim final rule" (75 FR 63346)).

⁵⁶² Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, Section 5.13, http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf

Broadly, offshore installations are required to follow best international practices and additional requirements for well barriers can be specified in a licence or an approval letter from the Bureau of Minerals and Petroleum.

Comparison to the Canadian Arctic Offshore

Greenland is dissimilar to the Canadian Arctic offshore in that use of barriers is not specifically required during all well operations in Greenland.

6.4.5 Norway

The concept of well barriers and the control of barriers are prominent in Norway. Barriers are applied to reduce the probability of failures, hazards and accident situations developing and to limit possible harm and disadvantages.⁵⁶³ Barriers are to be selected based on a determination of the potential to reduce risk, with prioritization for those barriers that reduce collective risk rather than individual risk.⁵⁶⁴

Tested barriers are required during drilling and well activities.⁵⁶⁵ The regulations do not state how many barriers are required, but do state that when more than one barrier is necessary, each barrier must function independently so that multiple important barriers will not malfunction simultaneously.⁵⁶⁶

If a barrier fails, no other activities shall take place other than those intended to restore the well barrier.⁵⁶⁷ Well barriers “shall be designed such that well integrity is ensured and the barrier functions are safeguarded during the well’s lifetime.”⁵⁶⁸ Barriers must also be designed so that their performance can be verified.⁵⁶⁹ The guidelines for both sections refers to NORSOK D-010 which requires the operator to define their well barriers and their acceptance criteria prior to commencement of an activity or operation and give guidance on the acceptance criteria for a well barrier and how it can be tested and monitored.⁵⁷⁰

Comparison to the Canadian Arctic Offshore

Norway’s regulations are similar to the Canadian Arctic offshore in that barriers are required during all well activities, but dissimilar to the Canadian Arctic offshore in that the number of

⁵⁶³ Petroleum Safety Authority Norway, *Regulations Relating to Management and the Duty to Provide Information in the Petroleum Activities and at Certain Onshore Facilities (The Management Regulations)*, Section 5, <http://www.ptil.no/management/category401.html>.

⁵⁶⁴ Ibid., Section 4.

⁵⁶⁵ Petroleum Safety Authority Norway, *Regulations Relating to Conducting Petroleum Activities (The Activities Regulations)* 2008, Section 85, <http://www.ptil.no/activities/category399.html>.

⁵⁶⁶ Petroleum Safety Authority Norway, *Management Regulations*, Section 5.

⁵⁶⁷ Petroleum Safety Authority Norway, *Activities Regulations*, Section 85.

⁵⁶⁸ Petroleum Safety Authority Norway, *Regulations Relating to Design and Outfitting of Facilities, etc. in the Petroleum Activities (The Facilities Regulations)*, 2010, Section 48, <http://www.ptil.no/facilities/category400.html>.

⁵⁶⁹ Ibid. Ibid.

⁵⁷⁰ Petroleum Safety Authority Norway, *Guidelines Regarding The Activities Regulations*, 2010, Re Section 85, <http://www.ptil.no/activities/category404.html>.

barriers required is not stated. Another similar aspect of these countries' regulations is the requirement that in the event of a barrier failure, all work and activities must be focused on restoring the barrier.

7. Independent Verification of Safety

This chapter examines the requirements for independent verification of safety for offshore drilling operations in the Canadian Arctic offshore, U.S., U.K., Greenland and Norway. A comparison of this requirement among all jurisdictions is made in Table 8 (below).

Regulatory provisions for independent verification vary widely, hindering any precise definition for this element of offshore oil and gas regulation. In general, they provide for some third-party, private-sector expert or firm, defined in the regulations, to review a facility's planned or instituted safety features, whether structural, equipment, or operational, to ensure they meet some set of regulatory safety objectives of the larger regulatory regime. Examining examples of such systems gives the best, concrete sense of their functions and details.

Table 8. Comparison of regulatory provisions for independent verification of safety by jurisdiction to Canadian Arctic Offshore

Regulatory Topic	Canadian Arctic Offshore	United States	United Kingdom	Greenland	Norway
1. Independent verification of fitness	Consolidated and comprehensive application of one verification scheme to all “prescribed equipment or installation[s].”	Specific verification schemes for three areas of regulation: 1) blowout preventer (BOP) requirements; 2) platform structural requirements for certain types of facilities; and 3) management system audit.	Specific verification schemes for two areas of regulation: 1) safety case (management system) audit; and 2) facility’s safety-critical elements (SCEs).	Consolidated and comprehensive application of one requirement to ensure drilling equipment conforms with minimum industry standards.	Consolidated and comprehensive verification scheme for compliance with all health, safety, and environment legislation.
	Certificate of fitness is mandatory to obtain authorization for a proposed work or activity, and must be valid for life of work.	1) BOP: mandatory to obtain necessary approval to begin drilling a well; 2) platforms: mandatory for certain higher risk platform types; and 3) management systems: mandatory audit by operator, but regulator can require third-party audit if it detects deficiencies in management system.	1) safety case: mandatory but allows an employee who is sufficiently independent of the system to perform audit; 2) SCEs: mandatory to implement verification scheme before completing installation or moving it into place.	Certificate of fitness is necessary to obtain an approval to drill, under Greenland’s March 2010 Exploration Drilling Guidelines.	Verification scheme not mandatory: owner or operator determines need for verification program.
	Verifies both technical compliance with a certain set of regulations (fit for compliance) and fitness for purpose of safety and	1) BOP: fit for compliance with specific technical BOP requirement; 2) platforms: fit for compliance with approved design plan	1) safety case: assess fitness for compliance of management system with safety case regulatory requirements; 2) SCEs: fit for purpose	Verifies technical compliance with minimum industry standards.	Verifies fitness for compliance of installations with health, safety, and environment legislation.

Independent Verification of Safety

	<p>environmental protection.</p>	<p>and fit for purpose of withstanding specific conditions of facility; and 3) management systems: fit for compliance with management system regulations and fit for purpose of safety and environmental importance.</p>	<p>of avoiding and mitigating effects of major accidents.</p>		
	<p>Prescribe relatively precise verification methodology, including short list from which certifying authority must be selected and details to be certified.</p>	<p>1) BOP: relatively precise methodology, though not a closed verifier list; 2) platform: precise methodology mandated, though not a closed verifier list; and 3) management systems: precise methodology mandated.</p>	<p>1) safety case: very few detailed requirements, only “adequate arrangements for audit” to assess adequacy to comply with relevant statutory provisions; 2) SCEs: development of verification methodology left largely to owner or operator to develop in consultation with relatively openly chosen third party.</p>	<p>Verification requirements not sufficiently developed to assess detail of prescriptions, but must use short list of four recognized certifying authorities.</p>	<p>Scope, nature, and details of verification program left to the owner or operator.</p>

7.1 Independent verification of fitness

7.1.1 Canadian Arctic Offshore

Relevant Canadian law is focused and consolidated on independent, expert verification of fitness for purpose as well as compliance with applicable regulations and NEB requirements or conditions.

Before the NEB can issue the necessary authorization for a proposed work or activity in respect of exploration and drilling for Arctic offshore oil and gas under section 5 of the *Canada Oil and Gas Operations Act* (COGOA), it must receive a certificate of fitness from the applicant. Section 5.12(1) of COGOA requires the applicant to obtain and submit a certificate by a “certifying authority” stating that any prescribed equipment or installation:

- “is fit for the purposes for which it is to be used and may be operated safely without posing a threat to persons or to the environment in the location and for the time set out in the certificate”⁵⁷¹ (fit for purpose) and
- conforms with any requirements and conditions that regulations impose generally or that the NEB imposes for the specific project under Section 5(4) of COGOA (fit for compliance).⁵⁷²

Under the *Canada Oil and Gas Certificate of Fitness Regulations (Fitness Regulations)* promulgated to implement Section 5.12 of COGOA, this certificate of fitness requirement, applicable to installations at offshore production and drilling sites,⁵⁷³ requires that the applicant obtain the certificate of fitness from a listed certifying authority. The regulations list five such organizations.⁵⁷⁴ The authority cannot have participated in the design, construction or installation of the relevant equipment or structure.⁵⁷⁵

To issue the certificate of fitness, the certifying authority must determine that the installation is “designed, constructed, transported and installed or established in accordance with” three sets of regulations: Parts I to III of the *Canada Oil and Gas Installations Regulations*; a long set of specific sections of the *Oil and Gas Occupational Safety and Health Regulations*, listed in Part 1 of the Schedule to the *Fitness Regulations*; and a list of specific sections of the *Canada Oil and Gas Diving Regulations*, listed in Part 2 of that Schedule.⁵⁷⁶

⁵⁷¹ Government of Canada, *Canada Oil and Gas Operations Act* 1985, c. O-7, Sections 5.12(1), (3), <http://laws-lois.justice.gc.ca/eng/acts/O-7/FullText.html?term=response>.

⁵⁷² Ibid., Section 5.12(3)

⁵⁷³ Government of Canada, *Canada Oil and Gas Certificate of Fitness Regulations* SOR/96-114, Section 4(1), <http://laws-lois.justice.gc.ca/eng/regulations/SOR-96-114/FullText.html>.

⁵⁷⁴ Ibid., Section 2. The list consists of the American Bureau of Shipping, Bureau Veritas, Det Norske Veritas Classification A/S, Germanischer Lloyd or Lloyd’s Register North America, Inc.

⁵⁷⁵ Government of Canada, *Canada Oil and Gas Operations Act*, Section 5.12(4); see also Government of Canada, *Canada Oil and Gas Certificate of Fitness Regulations*, Section 5.

⁵⁷⁶ Government of Canada, *Canada Oil and Gas Certificate of Fitness Regulations*, Section 4(2)(a).

The certifying authority must also determine that the installation is “fit for the purpose for which it is to be used and can be operated safely without polluting the environment.”⁵⁷⁷ This is done with a view to the drill site or region of operation; the certificate is valid only for the site or region that the certifying authority has endorsed on the certificate.⁵⁷⁸ Moreover, if an installation can only meet these requirements under certain limited operating conditions, the certifying authority must endorse the certificate of fitness with the details of these limitations.⁵⁷⁹

7.1.2 United States

The U.S. regulatory regime does not have a consolidated regulation of general application for independent verification across regulatory requirements. It does, however, include different, specific, mandatory independent verification schemes for two areas of regulation: 1) a critical blowout preventer (BOP) requirement; and 2) high-risk platform structural requirements. Each provides verification that plans meet precise technical requirements (fit for compliance), while the latter also ensures more broadly that platforms are appropriate for their location and conditions (fit for purpose). There is also an auditing requirement under the new mandatory Safety and Environmental Management Systems (SEMS) program, but it allows for an employee as an alternative to an independent third-party auditor. As such, independent verification is not a requirement of this program unless the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) decides, within its discretion, to direct an independent third-party audit.

First, to obtain the necessary BOEMRE approval to begin drilling a well,⁵⁸⁰ new regulations⁵⁸¹ require that the applicant’s Application for Permit to Drill include independent, third-party verification that the planned BOP system meets the pre-existing requirement⁵⁸² that its blind-shear rams are capable of shearing the drill pipe that is in the hole at the maximum anticipated surface pressure.⁵⁸³ Moreover, for subsea BOP stacks, the third-party verification must show that the stack is designed for the specific equipment on the rig and for the specific well design, that the stack has not been compromised or damaged from previous service, and that the stack will operate in the conditions in which it will be used.⁵⁸⁴ The applicant has broad discretion to choose

⁵⁷⁷ Ibid.

⁵⁷⁸ Ibid., Sections 5(2)(a), 8.

⁵⁷⁹ Ibid., Section 4(4).

⁵⁸⁰ See “How do I obtain approval to drill a well?,” U.S. Code of Federal Regulations Title 30, Pt. 250.410.

⁵⁸¹ BOEMRE introduced this independent third-party verification requirement in October with an enforceable interim rule implementing new safety measures. U.S. National Archives and Records Administration, “Oil and Gas and Sulphur Operations in the Outer Continental Shelf—Increased Safety Measures for Energy Development on the Outer Continental Shelf; Final Rule,” *Federal Register* 75, no. 198 (October 14, 2010): 63346, <http://edocket.access.gpo.gov/2010/pdf/2010-25256.pdf>. Though notice and comment continues and BOEMRE might modify the final rule, the interim rule is presently enforceable.

⁵⁸² “What are the requirements for a surface BOP stack?,” U.S. Code of Federal Regulations Title 30, Pt. 250.441(b); “What are the requirements for a subsea BOP system?,” U.S. Code of Federal Regulations Title 30, Pt. 250.442(a).

⁵⁸³ “What must I include in the diverter and BOP descriptions?,” U.S. Code of Federal Regulations Title 30, Pt. 250.416(e).

⁵⁸⁴ Ibid., Pt. 250.416(f).

a verifier, but must submit evidence demonstrating the independent third party's reputability, expertise and appropriate licensure.⁵⁸⁵

Second, BOEMRE has a Platform Verification Program (PVP) for ensuring that all floating platforms as well as certain higher risk fixed platforms (new designs or platforms in seismic areas, frontier waters, or water depths exceeding 122 metres) meet stringent requirements for design and construction.⁵⁸⁶ As one part of the PVP, the applicant must nominate a Certified Verification Agent (CVA) for BOEMRE's approval based on experience and ability for verification of offshore oil and gas platform design, fabrication, and installation.⁵⁸⁷ The CVA assesses the platform's design and any modification or repair to ensure that they are designed to "withstand environmental and functional load conditions appropriate for the intended service life at the proposed location", submitting reports to BOEMRE.⁵⁸⁸ The CVA then ensures that the platform's fabrication is done in accordance with the approved design and fabrication plan and that installation procedures and equipment are appropriate, with similar reporting requirements.⁵⁸⁹

Finally, under the new mandatory SEMS program, BOEMRE requires a facility to audit its SEMS program within two years of its implementation and every three years thereafter.⁵⁹⁰ The audit is to evaluate compliance with BOEMRE's SEMS program requirements (fit for compliance), as well as to "identify areas in which safety and environmental performance needs to be improved"⁵⁹¹ (fit for purpose). The results of the audit must be provided to BOEMRE for review, with a precise plan to address deficiencies. In the first instance, the audit can be performed either by an independent third party or by a "designated and qualified personnel,"⁵⁹² which is an employee with experience in implementing and auditing an offshore oil and gas management system.⁵⁹³ However, the operator must "have procedures to avoid conflicts of interests" with the designated and qualified personnel.⁵⁹⁴ Moreover, BOEMRE can direct an independent third-party audit or conduct its own audit if it "identifies safety or non-compliance

⁵⁸⁵ *Ibid.*, Pt. 250.416(g).

⁵⁸⁶ "What are the management's general responsibilities for the SEMS program?", U.S. Code of Federal Regulations Title 30, Pt. 250.909; "What safety and environmental information is required?", U.S. Code of Federal Regulations Title 30, Pt. 250.910.

⁵⁸⁷ "What criteria must be documented in my SEMS program for safe work practices and contractor selection?," U.S. Code of Federal Regulations Title 30, Pt. 250.914.

⁵⁸⁸ "What criteria for mechanical integrity must my SEMS program meet?," U.S. Code of Federal Regulations Title 30, Pt. 250.916.

⁵⁸⁹ "What criteria for pre-startup review must be in my SEMS program?," U.S. Code of Federal Regulations Title 30, Pt. 250.917; "What criteria for emergency response and control must be in my SEMS program?," U.S. Code of Federal Regulations Title 30, Pt. 250.918.

⁵⁹⁰ "What are the auditing requirements for my SEMS program?," U.S. Code of Federal Regulations Title 30, Pt. 250.1920.

⁵⁹¹ *Ibid.*

⁵⁹² *Ibid.*

⁵⁹³ "Definitions," U.S. Code of Federal Regulations Title 30, Pt. 250.1903.

⁵⁹⁴ "What qualifications must an independent third party or my designated and qualified personnel meet?," U.S. Code of Federal Regulations Title 30, Pt. 250.1926.

concerns based on the results of [BOEMRE's] inspections and evaluations,” which seem to be limited to prior audits.⁵⁹⁵

Comparison to the Canadian Arctic Offshore

In the U.S., the three separate schemes for independent verification are feature-specific and only applicable to particular elements of an installation. This differs from requirements in the Canadian Arctic offshore for consolidated independent verification, applicable across a number of regulatory requirements and more comprehensively addressing many features of installations. Like in the Canadian Arctic offshore, the U.S. independent verification schemes look to both fit-for-compliance with regulatory requirements and fit-for-purpose considerations and mandate relatively precise programs for independent verification, though the U.S. does not delimit a shortlist of authorized verifiers.

7.1.3 United Kingdom

The U.K.'s *Safety Case Regulations* (OSCR) require offshore installations to engage two types of “independent” review: 1) safety case (management system) audits; and 2) verification of safety-critical elements. The first is a fit-for-compliance verification with respect to entire management systems, but allows for employee involvement, similar to the U.S. system. The second is a fit-for-purpose requirement that installations implement a verification scheme, placing primary onus on the installation to design and implement its scheme with independent consultation and review.

Regulation 12(1)(b) of the OSCR requires duty holders (owners and operators) to submit, along with their required “safety case” management system, details of establishing “adequate arrangements for audit” and for making audit reports for this very safety case.⁵⁹⁶ The audit is to systematically assess the adequacy of the management system to comply with the relevant statutory provisions.⁵⁹⁷ However, an employee can carry out the audit, so long as the employee is “sufficiently independent of the system ... to ensure that such assessment is objective.”⁵⁹⁸

Regulation 19 of the OSCR requires the duty holder to design and implement a verification scheme for managing its safety-critical elements (SCEs), all before an installation is completed or moved into place for operation. The duty holder must first produce a record of the installation's SCEs — the parts of an installation that are key for avoiding major accidents or for limiting their effects.⁵⁹⁹ The duty holder must then:

⁵⁹⁵ “May BOEMRE direct me to conduct additional audits?,” U.S. Code of Federal Regulations Title 30, Pt. 250.1925.

⁵⁹⁶ Government of the U.K., *The Offshore Installations (Safety Case) Regulations 2005*, Statutory Instruments 2005 No. 3117, Regulation 12(3), <http://legislation.data.gov.uk/ukxi/2005/3117/made/data.htm?wrap=true>.

⁵⁹⁷ Ibid.

⁵⁹⁸ Ibid.

⁵⁹⁹ SCR Regulation 2(1) defines SCEs as those parts of an installation “the failure of which could cause or contribute substantially to ... a major accident” or “a purpose of which is to prevent, or limit the effect of, a major accident”. Government of the U.K., *The Offshore Installations (Safety Case) Regulations 2005*, Regulation 2(1). Regulation 2(1) also defines “major accidents” by listing a set of events, such as a fire, explosion, major damage to the

- engage an “independent and competent person” (ICP) to comment on the record of SCEs and to consult on or actually draw up a verification scheme;
- put the verification scheme into effect and note any reservations that the ICP has with respect to the record or the scheme;⁶⁰⁰ and
- regularly review the verification scheme in consultation with an ICP with a view to revising it where necessary, again noting any of the ICP’s reservations with the result.⁶⁰¹

The verification scheme must ensure that the SCEs and the specified plant will be suitable or, if the SCEs are already provided, are suitable and remain in good repair and condition.⁶⁰² The verification scheme ensures this suitability (fitness for purpose) through examinations and testing by the ICP of various elements of the installation and operations, including the SCEs, any design or specification or other type of document, work in progress, actions taken in response to ICP reports, and even the verification scheme itself.⁶⁰³ The scheme must therefore provide for the nature and frequency of these examinations, as well as the principles applied in selecting the ICP and reviewing and revising the scheme itself, and a system for communicating results of examinations and remedial actions to “an appropriate level in the management system.”⁶⁰⁴

The ICP cannot ever be or have been responsible for any aspect of anything under the verification scheme under examination and must be “sufficiently independent of a management system ... to ensure that he will be objective in discharging his function.”⁶⁰⁵ This might not necessarily exclude an employee as ICP and certainly does not mandate any list of outside firms.

In this way, the verification scheme requirements are restricted to a particular area of regulation: namely, controlling the risk of major accidents and verifying that the parts of an installation that are intended to be suited to this purpose, the SCEs, indeed are.

The verification system, a feature of the U.K.’s move to a goal-setting regime placing primary regulatory onus on facility owners and operators, contrasts with the prior “certificate of fitness” requirements under previous regulations.⁶⁰⁶ Instead of mandating a detailed verification system and set of approved verifiers, the requirements for the verification scheme in the U.K. now leave even the scheme development largely for the facility owner or operator to develop, in consultation with their chosen ICP. Even choosing the ICP is subject to broader, less detailed guidance, with onus on the duty holder to justify the selection.

installation’s structure, helicopter collision, or any even involving death or serious personal injury to five or more persons.

⁶⁰⁰ Government of the U.K., *The Offshore Installations (Safety Case) Regulations 2005*, Regulation 19(2).

⁶⁰¹ *Ibid.*, Regulation 20.

⁶⁰² *Ibid.*, Regulation 2(5).

⁶⁰³ *Ibid.*, Regulation 2(6).

⁶⁰⁴ *Ibid.*, Schedule 7.

⁶⁰⁵ *Ibid.*, Regulation 2(7),.

⁶⁰⁶ See Bomel Limited, *An Evaluation of Current Legislative Requirements for Verification of Elements Critical to the Safety of Offshore Installations*, 2005, 1-2, <http://www.hse.gov.uk/research/rrpdf/rr397.pdf>.

Comparison to the Canadian Arctic Offshore

More like the U.S. than Canadian Arctic offshore, the U.K.’s only independent verification program is specific to particular elements of offshore installation management, the safety case system and safety critical elements. Unlike both Canadian Arctic offshore and the United States, however, the U.K. requirements leave substantial discretion to the installation to design its verification procedures and to select a verifier, including employees.

7.1.4 Greenland

Among the requirements for obtaining an Approval to Drill in Greenland’s March 2010 Exploration Drilling Guidelines is that the operator obtain a certificate of fitness for the drilling installation, issued by one from among a list of four recognized certifying authorities.⁶⁰⁷ The certification is intended to ensure that the drilling equipment on the installation “conform[s] to API and other accepted minimum industry standards.”⁶⁰⁸ Moreover, the Guidelines require certification to ascertain that a standby vessel for rescue is available and “equipped in accordance with recognized international standards.”⁶⁰⁹ Additional requirements for independent verification of fitness can be specified in a licence or an approval letter from the BMP.

Comparison to the Canadian Arctic Offshore

Greenland’s independent verification scheme is, like that for the Canadian Arctic offshore, consolidated to ensure verification of compliance across regulations and, in Greenland’s case, even industry standards. Like in Canada’s National Energy Board’s binding regulations, Greenland’s Guidelines limit verifier selection to an authorized shortlist. Other than this, however, Greenland’s mandatory Guidelines are not as precise on the procedural details of the verification process.

7.1.5 Norway

In accord with its emphasis on operator responsibility in attaining the purposes of the offshore regulations in Norway, the *Framework Regulations*⁶¹⁰ leave the verification requirements for the facility operator’s determination. Though not prescriptive, the verification system suggested would seek to ensure compliance with all health, safety and environment (HSE) legislation.

Section 19 of the *Framework Regulations* states that the “responsible party shall determine the need for and scope of verification method and its degree of independence” for the purpose of

⁶⁰⁷ The recognized certifying authorities are: American Bureau of Shipping, Bureau Veritas, Det Norske Veritas, and Lloyd’s Register of Shipping. Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, 4, http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf.

⁶⁰⁸ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, Section 1.1.

⁶⁰⁹ Ibid.

⁶¹⁰ Petroleum Safety Authority Norway, *Regulations Relating to Health, Safety, and the Environment in the Petroleum Activities and at Certain Onshore Facilities (The Framework Regulations)*, 2010, <http://www.ptil.no/framework-hse/category403.html>.

documenting “compliance with requirements in the [HSE] legislation.”⁶¹¹ Though falling short of mandating a verification program, where verification is “deemed necessary,” it shall be “carried out according to a comprehensive and unambiguous verification programme and verification basis.”⁶¹² Moreover, the operator must also “carry out an overall assessment of the results of [any] verifications that have been carried out.”⁶¹³

Comparison to the Canadian Arctic Offshore

Like the Canadian Arctic offshore and Greenland, Norwegian regulations establish only one independent verification scheme—in Norway’s case, for verifying compliance with all health, safety and environmental regulations. Norway’s independent verification requirements differ from the Canadian Arctic offshore requirements substantially, however, in the very open nature of the requirements, giving great latitude to the installation to decide on all aspects of its verification program, including the very need for a verification program at all. In this way, while included in legally binding regulations, Norway’s verification requirements are so open that they cannot be considered mandatory in practical effect. Instead, the installations must consider the need for verification, then proceed with an independent verification program appropriate to the circumstances.

⁶¹¹ Ibid., Section 19.

⁶¹² Ibid.

⁶¹³ Ibid.

8. Oil Spill Preparedness Requirements

This chapter examines the oil spill preparedness requirements for offshore drilling operations in the Canadian Arctic offshore, the U.S., the U.K., Greenland, and Norway. Legislation and regulations relating to oil spill preparedness fall under these categories: spill preparedness planning; roles and responsibilities in spill response; and capacity for response. A comparison of these requirements among all jurisdictions is made in Table 9 (below).

Spill preparedness planning

Oil spill preparedness planning is essential to avoid or minimize negative effects on the environment and human health from accidental discharge of petroleum from offshore facilities. A comprehensive and integrated strategy to address an incident should have well-defined roles for the operator, regulator and other government agencies. It is imperative that the strategy have requirements for reporting and communication; require a rapid response in the critical early stages of a spill; and ensure adequate capacity for long-term oil spill response, clean-up and remediation. Many jurisdictions have a multi-layer approach, with oil spill response plans required from the operator, at the regional level and the national level. These plans should clearly define roles and responsibilities, and promote sharing of equipment, personnel and expertise. The plans should be regularly tested through planned or unplanned exercises that simulate an oil spill incident.

Roles and responsibilities in spill response

Oil spill response must involve a large number of organizations due to the potential for widespread and diverse impacts. Government agencies at several levels may have jurisdiction over various aspects of spill response, and can provide different sets of expertise and guidance. To ensure a rapid, effective and coordinated response effort, roles and responsibilities should be clearly defined.

Capacity for response

Some jurisdictions have regulations that stipulate how the severity of a potential spill could be predicted or how the severity of an actual spill is assessed, and determine how to calculate the necessary equipment and personnel for a timely response.

Table 9. Comparison of oil spill preparedness requirements by jurisdiction to Canadian Arctic Offshore

Regulatory Topic	Canadian Arctic Offshore	United States	United Kingdom	Greenland	Norway
1. Spill preparedness planning	Operators are required to develop emergency response plans. Plans are subject to approval from the regulator. Guidelines recommend that the plan contain procedures, practices and resources to achieve compliance with legislation.	Operators are required to develop Oil Spill Response Plans. Plans are subject to approval from the regulator. Plans must identify equipment, personnel, communication systems, and procedure that will be followed in the event of an oil spill.	Operators are required to develop an Oil Pollution Emergency Plan. Plans are subject to approval from the regulator. Plans must contain actions, equipment and personnel required to respond. Plans are risk-based.	Pollution abatement procedures are required by legislation, and guidelines require that an Oil Spill Contingency Plan be developed as part of the Environmental Assessment process.	Contingency plans are required for activities that have risk of pollution. Plans are subject to approval from the regulator. Plans are based on a risk analysis, which takes into account season, type of oil, and efficiency of equipment.
	Regulations require a description of monitoring and compliance to be approved by the regulator, but do not specify testing requirements.	Regulations require that operators' plans must be tested every three years and exercises must be held.	Regulations require that a major oil pollution exercise is held every year and an offshore installation exercise is held every five years.	There is no requirement to test oil spill response in the guidelines, although such requirements could be included in a licence or an approval letter.	Guidelines recommend that plan be tested annually.

Oil Spill Preparedness Requirements

	Regional and national contingency plans are required by legislation.	Regional and national contingency plans are required by legislation.	Regional and national contingency plans are required by legislation.	An Emergency Management Programme exists to coordinate national response, but is not required by legislation.	Regional and national contingency plans are required by legislation.
2. Roles and responsibilities in spill response	Operators are required to take all reasonable measures to rectify a spill. The National Energy Board is the main oversight body and has the power to intervene if operator action is inadequate.	Operators are required to implement their Oil Spill Response Plan. BOEMRE is the main oversight body and has the power to intervene if operator action is inadequate.	Operators are required to implement their Oil Pollution Emergency Plans. The Department of Energy and Climate Change is the main oversight body. Other national bodies have the power to intervene if operator action is inadequate.	Operators are required to take any practically feasible measure to reduce and prevent damage in the case of a spill, and the Bureau of Minerals and Petroleum is the main oversight body. The national government has power to issue enforcement notices or create/extend safety zones to avoid or limit damage and prevent pollution.	Operators are required to take measures to avoid a spill and limit damage in the case of a spill. The Norwegian Coastal Administration is the main oversight body. The national government and municipal governments have the power to intervene if operator action is inadequate.
3. Capacity for response	There are no regulations specific to calculating spill severity. Response equipment is required in sufficient quantities for “reasonably foreseeable” emergency conditions.	Spill severity is calculated using a worst case scenario. Capacity for response is calculated as equipment required to respond to a maximum blowout, multiplied by 20%.	Spill severity is divided into three categories based on response requirements. Capacity for response is required by application of response time targets.	Spill severity is divided into ‘major’ and ‘minor’, but spill volume is not defined. Specific equipment requirements are not stated, although such requirements could be included in a licence or an approval letter.	Response is required to be in reasonable proportion to the probability of pollution and damage. Specific equipment requirements are not stated.

8.1 Spill preparedness planning

8.1.1 Canadian Arctic Offshore

As part of an application for well authorization, an operator must create contingency plans, including an Emergency Response Plan (ERP). The plan is required to identify potential hazards, abnormal situations, emergencies, incidents and accidents that could have an impact on safety.⁶¹⁴

Emergency Response plans must be coordinated with other emergency response plans at the municipal, provincial, territorial or federal level.⁶¹⁵ Operators are required to identify the scope and frequency of the field practice exercise for offshore facilities,⁶¹⁶ and to submit an annual environmental report that includes a summary of contingency plan exercises.⁶¹⁷

In addition, operators in the Beaufort Sea are required under section 13(10) of the Inuvialuit Final Agreement to estimate of the potential liability from damage to the wildlife from an oil spill under a worst case scenario.⁶¹⁸

The NEB reviews the ERP for completeness and effectiveness of the emergency response, spill contingency, and spill response exercises.⁶¹⁹ During operations, the NEB can conduct inspections to ensure that the ERP is known to working personnel.⁶²⁰

The National Environmental Emergencies Contingency Plan⁶²¹ is headed by Environment Canada and required under the *Emergencies Act*⁶²² and *Emergency Preparedness Act*⁶²³ along with components of the *Canadian Environmental Protection Act*⁶²⁴ and *Canadian Environmental*

⁶¹⁴ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations* 2009, SOR/2009-315, Section 6 (j), <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

⁶¹⁵ Ibid.

⁶¹⁶ Ibid.

⁶¹⁷ Ibid., Section 86(1).

⁶¹⁸ Government of Canada, *Inuvialuit Final Agreement*, 1984, http://www.collectionsCanada.gc.ca/webarchives/20071125181720/http://www.ainc-inac.gc.ca/pr/agr/inu/wesar_e.pdf.

⁶¹⁹ National Energy Board, “Emergency Planning and Response,” <http://www.neb-one.gc.ca/clf-nsi/rthnb/nrthffshr/mrgncplnnngrspns-eng.html>.

⁶²⁰ Ibid.

⁶²¹ Environment Canada, *National Environmental Emergencies Contingency Plan* 1999 http://www.ec.gc.ca/ee-ue/CC95B410-2E9B-48AB-ABE4-2F9143FD250E/contingency_e.pdf.

⁶²² Government of Canada, *Emergencies Act*, 1985, c. 22 (4th Supp.) <http://laws-lois.justice.gc.ca/eng/acts/E-4.5/index.html>.

⁶²³ Government of Canada, *Emergency Preparedness Act*, 1985, c. 6 (4th Supp.) <http://laws-lois.justice.gc.ca/eng/acts/E-4.6/>.

⁶²⁴ Sections 8, 199 and 200 authorize the preparation and implementation of an environmental emergency plan, Government of Canada, *Canadian Environmental Protection Act*, 1999, c. 33 <http://laws-lois.justice.gc.ca/eng/acts/C-15.31/>.

Assessment Act.⁶²⁵ This plan details responsibilities of various agencies during environmental emergencies (including oil spills) and a general framework for procedures during emergencies.

The regional application of this plan in the Arctic is the Arctic Regional Environmental Emergency Team (REET) Contingency Plan, which describes the organizational framework, purpose, functions and composition of the team, notification and activation procedures that would be followed in the event of a spill, and the classification and escalation of response to environmental emergencies.

8.1.2 United States

Operators are required to develop regional and/or site-specific Oil Spill Response Plans (OSRP) prior to submitting an Exploration Plan or a Development Operations Coordination Document by 30 CFR 254. Operators are required to use "Best Available and Safest Technology"⁶²⁶ in the OSRP⁶²⁷ but are allowed to use new or alternative techniques, procedures, equipment, or activities if they allow improved protection, safety, or performance than current technologies.⁶²⁸ The plan must address the continued response to a blowout lasting 30 days.⁶²⁹ Guidance is provided for the preparation of OSRP by a number of Notice To Lessees (NTL).⁶³⁰

An Emergency Response Action Plan is required as a component of the OSRP.⁶³¹ This plan must include:

- Designation of a trained spill management team,
- Description of a spill-response operating team,
- A planned location for a spill-response operations centre and provisions for primary and alternate communications systems,

⁶²⁵ Government of Canada, *Canadian Environmental Assessment Act*, 1992, c-37, Section 16, <http://laws-lois.justice.gc.ca/eng/acts/C-15.2/>.

⁶²⁶ No definition of Best Available and Safest Technology is provided in the regulation. Implementation of this regulation is beyond the scope of this document.

⁶²⁷ "What must I do to protect health, safety, property, and the environment?," U.S. Code of Federal Regulations Title 30, Pt. 250.107(c).

⁶²⁸ May I ever use alternate procedures or equipment?," U.S. Code of Federal Regulations Title 30, Pt. 250.141.

⁶²⁹ "What information must I include in the "Worst case discharge scenario" appendix?," U.S. Code of Federal Regulations Title 30, Pt. 254.26 (d)(1).

⁶³⁰ U.S. Bureau of Ocean Energy Management, Regulation and Enforcement, *Notice to Lessees: Statement of Compliance with Applicable Regulations and Evaluation of Information Demonstrating Adequate Spill Response and Well Containment Resources*, NTL No. 2010-N10, <http://www.gomr.boemre.gov/homepg/regulate/regs/ntls/2010NTLs/10-n10.pdf>; *Notice to Lessees: Oil Spill Response Plan*, NTL No. 2009-P03, <http://www.gomr.boemre.gov/homepg/regulate/regs/ntls/2009NTLs/09-P03.pdf>; and *Notice to Lessees: Regional and Sub-Regional Oil Spill Response Plans*, NTL No. 2006-G21, <http://www.gomr.boemre.gov/homepg/regulate/regs/ntls/2006%20NTLs/06-g21.pdf>.

⁶³¹ "What information must I include in the "Emergency response action plan" section?," U.S. Code of Federal Regulations Title 30, Pt. 254.23.

- Identification of procedures that will be followed in the event of a spill or a substantial threat of a spill, including methods to monitor and predict spill movement, to remove oil and oiled debris from shallow waters and along shorelines, to ensure that containment and recovery equipment and response personnel are mobilized and deployed, and to identify, prioritize and protect areas of special economic and environmental importance.

All OSRPs must be in compliance with the National Contingency Plan and applicable Area Contingency Plans (detailed below).

Oil spill response plans must be exercised at least once every three years.⁶³² Operators are required by 30 CFR 254.5 to carry out the training, equipment testing, and periodic drills described in the plan in order to ensure the safety of the facility and to mitigate or prevent a discharge or a substantial threat of a discharge. An exercise program has been developed to provide operators with a mechanism for compliance with the exercise requirements of legislation.⁶³³

The National Contingency Plan (NCP) was created in 1968 and substantially expanded in response to the *Exxon Valdez* spill by the *Oil Pollution Act* of 1990.⁶³⁴ This plan coordinates the actions of all federal and state agencies, owners or operators of facilities, and other persons participating in oil spill response.⁶³⁵ The goal of the plan is to ensure efficient, coordinated and effective response to discharges of oil. The NCP must:

- assign duties and responsibilities to federal and state government departments and agencies,
- identify storage of equipment and supplies,
- establish requirements for federal, regional, and area contingency plans,
- create system of surveillance and notice to communicate information about discharges of oil,
- establish a national centre to provide coordination and direction for operations,
- outline procedures and techniques to be employed to remove oil, and
- provide procedures for the participation of other persons in response actions.

Area Contingency Plans are more detailed and specific than the National Contingency Plan. They must describe in detail the specific region, including identification of areas of special economic or environmental importance that might be damaged by a discharge, discuss in detail the responsibilities of an owner/operator and of national, state and local government department and agencies, list available equipment and personnel, list local scientists with expertise in the environmental effects of oil spills who may be contacted to provide information or support, and

⁶³² “Exercises for your response personnel and equipment,” U.S. Code of Federal Regulations Title 30, Pt. 254.42.

⁶³³ U.S. Bureau of Ocean Energy Management, Regulation and Enforcement, *National Preparedness For Response Exercise Program (PREP) Guidelines*, 2002, <http://www.boemre.gov/offshore/OilSpillProgram/Assets/PDFs/PREPGuidelines.pdf>

⁶³⁴ “Clean Water Act- Oil and hazardous substance liability,” U.S. Code of Federal Regulations Title 33, Pt. 1321.

⁶³⁵ *Ibid.*, Pt. 1321(6)(d).

discuss how the plan is integrated into other OSRPs, other Area Contingency Plans and the National Contingency Plan.⁶³⁶

Comparison to the Canadian Arctic Offshore

Similar to the requirements for the Canadian Arctic offshore, the U.S. requires a response plan from operators which is subject to approval from the regulator. Slightly divergent from the regulations for the Canadian Arctic offshore, the U.S. sets out the detailed content of the plan in the regulations, while Canada's National Energy Board recommends detailed content within guidelines. United States requires that plans be tested every three years, whereas Canada's National Energy Board does not specify the frequency. Like Canada's regulations for the Arctic offshore, the U.S. has legislation and regulation requiring a national and regional response coordination plan.

8.1.3 United Kingdom

The *Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation Convention) Regulations*⁶³⁷ and the *Offshore Installations (Emergency Pollution Control) Regulations*⁶³⁸ cover oil spill emergencies for both shipping and offshore installations. These regulations require operators to prepare and submit an Oil Pollution Emergency Plan (OPEP).⁶³⁹ OPEPs detail actions, equipment and personnel required to respond to oil spills. Plans are specific to fields or installations, and cover all phases of activity. They also cover pollution incident scenarios and hazard identification, pollution incident assessment, dispersant use, aerial surveillance requirements, and a shoreline protection plan. The Maritime and Coast Agency assesses the plan and may ask for alteration if they feel it is not adequate to address a spill.⁶⁴⁰ OPEPs are subject to approval by Department of Energy and Climate Change.

Emergency preparedness is also a significant requirement of the safety case required under *The Offshore Installations (Safety Case) Regulations 2005* (see Chapter 4 of this document).

The National Contingency Plan (NCP) is a national plan for pollution emergencies required under the *Merchant Shipping Act 1995*⁶⁴¹ as amended by the *Merchant Shipping and Maritime Security Act 1997*.⁶⁴² The NCP sets out the government arrangements for dealing with an

⁶³⁶ Ibid., Pt. 1321(j)(4).

⁶³⁷ These Regulations implement, in part, the International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC) adopted by the International Maritime Organization.

⁶³⁸ Government of the U.K., *Offshore Installations (Emergency Pollution Control) Regulations 2002*, Statutory Instruments 2002, No. 1861, <http://www.legislation.gov.uk/ukSI/2002/1861/contents/made>.

⁶³⁹ Government of the U.K., *Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation Convention) Regulations 1998*, Statutory Instruments 1998, No. 1056, Section 4, <http://www.legislation.gov.uk/ukSI/1998/1056/made#f00002>.

⁶⁴⁰ Ibid., Section 6.

⁶⁴¹ Government of the U.K., *Merchant Shipping Act 1995*, Statutory Instruments 1995, c. 21, <http://www.legislation.gov.uk/ukpga/1995/21/section/128>.

⁶⁴² Government of the U.K., *Merchant Shipping and Maritime Security Act 1997*, Statutory Instruments 1997, c. 28, <http://www.legislation.gov.uk/ukpga/1997/28/contents>.

incident which requires a national response and the circumstances.⁶⁴³ The NCP details the roles and responsibilities of agencies in the response effort. To test the effectiveness of the NCP, and the integration of OPEPs, a major oil pollution exercise involving a shipping casualty is held every year and an offshore installation exercise is held every five years.⁶⁴⁴

Under the *Offshore Installations (Emergency Pollution Control) Regulations*, regional harbour authorities are also required to have an Oil Pollution Emergency Plan (OPEP), with similar requirements for content as an offshore installation.⁶⁴⁵

Comparison to the Canadian Arctic Offshore

Similar to the regulations for the Canadian Arctic offshore, the U.K. requires a response plan from operators which is subject to approval from the regulator. U.K. regulations differ from the Canadian Arctic offshore in that there is a requirement for annual testing of oil spill response. Like Canadian Arctic offshore requirements, the U.K. sets out the detailed content of the plan in guidelines, and has legislation and regulation requiring a national and regional response coordination plan.

8.1.4 Greenland

Under section 53 of the *Mineral Resources Act*, the operator is required to have emergency and pollution abatement procedures in place.⁶⁴⁶ The March 2010 Exploration Drilling Guidelines state that an Oil Spill Contingency Plan is required from operators during the environmental assessment process.⁶⁴⁷ An Emergency Response Plan is also required from operators to obtain approval for prospecting or production licence.⁶⁴⁸ The guidelines state that the Emergency Response Plan must include: a description of the organization; personnel; alarm, warning and communication procedures; location of equipment; spatial assessment of where spills may spread and where clean-up efforts will be employed; abatement strategies; procedures for disposal of collected oil; surveillance of the extent of the spill; and protection and clean-up of coasts.⁶⁴⁹

⁶⁴³ U.K. Maritime and Coastguard Agency, *National Contingency Plan For Marine Pollution From Shipping And Offshore Installations*, 2000, <http://www.dft.gov.uk/mca/mcga-contin.pdf>.

⁶⁴⁴ Government of the U.K., *Memorandum submitted by the Department of Energy and Climate Change, Health & Safety Executive, and Maritime and Coastguard Agency*, 2010, <http://www.publications.parliament.uk/pa/cm201011/cmselect/cmenergy/450/450we10.htm>.

⁶⁴⁵ Government of the U.K., *Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation Convention) Regulations 1998*, Statutory Instruments 1998, No. 1056, Section 4, <http://www.legislation.gov.uk/ukSI/1998/1056/made#f00002>.

⁶⁴⁶ Greenland Self Government, *Act Of 7 December 2009 On Mineral Resources and Mineral Resource Activities (The Mineral Resources Act)*, 2009, Section 53, http://www.bmp.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf.

⁶⁴⁷ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, 27-29, http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf.

⁶⁴⁸ Greenland Bureau of Minerals and Petroleum, *Exploration and exploitation of hydrocarbons in Greenland Strategy for Licence Policy*, 2009 http://www.bmp.gl/images/stories/about_bmp/publications/hydrocarbon_2009_uk.pdf.

⁶⁴⁹ Ibid.

Operators are also required to monitor oil concentrations and environmental impacts in the longer term.⁶⁵⁰

There are no references to testing oil spill preparedness plans in the March 2010 Exploration Drilling Guidelines.

The Greenland government does have a national coordination framework (the Emergency Management Programme for Hydrocarbon Activities) to coordinate government response to an incident, ensure compliance with regulatory requirements, and establish procedures for action, but this is not required under legislation.⁶⁵¹ There does not appear to be any legislative requirements for regional coordination planning.

Broadly, offshore installations are required to follow best international practices and additional requirements for spill preparedness planning can be specified in a licence or an approval letter from the BMP.⁶⁵²

Comparison to the Canadian Arctic Offshore

Like Canadian Arctic offshore requirements, operators are required to develop an oil spill response plan. Greenland does not have specific requirements for the operators to test their plan, although such requirements could be included in a licence or an approval letter. Dissimilar to Canadian Arctic offshore regulations, national and regional contingency plans are not required in Greenland's regulations or guidelines.

8.1.5 Norway

Operators are required to develop emergency preparedness plans based on a quantitative environmental risk analysis.⁶⁵³ The results from the environmental risk analysis are to be used by the operator to select the best emergency preparedness measures for the plan⁶⁵⁴ and to inform the regulator, who can require further emergency preparedness conditions in some cases.⁶⁵⁵

The regulations require that emergency preparedness plans must contain action plans for hazard and accident situations.⁶⁵⁶ Guidelines state that the emergency preparedness plans should include a description of emergency preparedness measures and decision criteria; response times; plans to remotely monitor the dispersal of oil; rationale for the choice of action based on minimising the

⁶⁵⁰ Ibid.

⁶⁵¹ Greenland Bureau of Minerals and Petroleum, "Emergency Response," <http://www.bmp.gl/petroleum/emergency-response>.

⁶⁵² Pers. Comm., Maja Sofie Burgaard, Special Advisor, Licence Department; Petroleum Section, Bureau of Minerals and Petroleum, Greenland Self-Government, May 5, 2011.

⁶⁵³ Petroleum Safety Authority Norway, *Regulations Relating to Conducting Petroleum Activities (The Activities Regulations)* 2008, Section 64, <http://www.ptil.no/activities/category399.html>.

⁶⁵⁴ Petroleum Safety Authority Norway, *Regulations Relating to Management and the Duty to Provide Information in the Petroleum Activities and at Certain Onshore Facilities (The Management Regulations)*, Section 17, <http://www.ptil.no/management/category401.html>.

⁶⁵⁵ Petroleum Safety Authority Norway, *Activities Regulations*, Section 73.

⁶⁵⁶ Ibid., Section 76.

environmental damage; plans for shore clean-up; and environmental surveys.⁶⁵⁷ The guidelines also recommend use of the Norsok U-100N⁶⁵⁸ standard which suggests the inclusion of an organization plan showing the lines of communication to be used in emergency, a breakdown of responsibility between relevant groups, and a description of equipment and procedures. Operators are also required to have an action plan that describes how lost well control can be regained.⁶⁵⁹

Guidelines recommend that least one annual exercise should be carried out to test emergency preparedness management and the regional emergency response.⁶⁶⁰ Regulations also require testing of equipment identified in the plan under “realistic conditions.”⁶⁶¹

The *Pollution Control Act* stipulates that emergency response systems must be provided at the regional and national level.⁶⁶² Section 78 of the *Activities Regulations* and section 21 of the *Framework Regulations* set out requirements for regional emergency preparedness. Regional plans must involve remote measurement of spilled oil, and plans must be updated or expanded in the event of new production facilities.

Operators are required to coordinate their efforts with public emergency preparedness resources⁶⁶³ and with other operators of other production licences in their region.⁶⁶⁴ There is a similar requirement in the *Pollution Control Act*.⁶⁶⁵

Comparison to the Canadian Arctic Offshore

Norway and Canada’s Arctic offshore regulations are similar in that both jurisdictions require a response plan from operators which is subject to approval from the regulator, and both have legislation and regulation requiring a national and regional response coordination plan.

⁶⁵⁷ Petroleum Safety Authority Norway, *Guidelines Regarding the Activities Regulations*, Re: Section 76, <http://www.ptil.no/activities/category404.html>.

⁶⁵⁸ Standards Norway, *NORSOK Standard U-100: Manned underwater operations*, 2009, <http://www.standard.no/PageFiles/13273/u100e3.pdf>.

⁶⁵⁹ Petroleum Safety Authority Norway, *Activities Regulations*, Section 86.

⁶⁶⁰ Petroleum Safety Authority Norway, *Guidelines Regarding the Activities Regulations*, Re: Section 23.

⁶⁶¹ Petroleum Safety Authority Norway, *Regulations Relating to Design and Outfitting of Facilities, etc. in the Petroleum Activities (The Facilities Regulations)*, 2010, Section 42, <http://www.ptil.no/facilities/category400.html>.

⁶⁶² Government of Norway, *Act of 13 March 1981 No.6 Concerning Protection Against Pollution and Concerning Waste (Pollution Control Act)*, 1981 No.6, Section 43, <http://www.regjeringen.no/en/doc/Laws/Acts/Pollution-Control-Act.html?id=171893>.

⁶⁶³ Petroleum Safety Authority Norway, *Regulations Relating to Health, Safety, and the Environment in the Petroleum Activities and at Certain Onshore Facilities (The Framework Regulations)*, 2010, Section 20, <http://www.ptil.no/framework-hse/category403.html>.

⁶⁶⁴ *Ibid.*, Section 21.

⁶⁶⁵ Government of Norway, *Pollution Control Act*, Section 41.

8.2 Roles and responsibilities in spill response

8.2.1 Canadian Arctic Offshore

Operators must, in the event of a spill, immediately cease any work or activity that causes or is likely to cause pollution, and must not resume this work or activity until they can do so without pollution.⁶⁶⁶ Operators are required to report the spill to the Chief Conservation Officer at the NEB.⁶⁶⁷ The operator must take “all reasonable measures consistent with safety and the protection of the environment to prevent any further spill, to repair or remedy any condition resulting from the spill and to reduce or mitigate any danger to life, health, property or the environment that results or may reasonably be expected to result from the spill.”⁶⁶⁸

The National Energy Board is the primary oversight body for spill response. Section 25(4) of COGOA states that if the Chief Conservation Officer has reasonable grounds to believe that a spill has occurred, that immediate action is necessary, but that the action is not being taken or will not be taken, then the Officer “may take such action or direct that it be taken by such persons as may be necessary.”⁶⁶⁹ The Officer can authorize and direct workers to enter the spill area, to take over the management and control of activities, and take all reasonable measures to prevent further spill and mitigate damages.

As the lead agency for spill response from offshore exploration and production facilities under the Northwest Territories/Nunavut Spills Working Agreement,⁶⁷⁰ the NEB is responsible for the initial evaluation of the spill, to coordinate action related to the spill, to ensure that containment and clean-up measures have been taken by the owner/operator, to obtain necessary assistance and advice and to provide update reports to other agencies, the public and media. The NEB can monitor the clean-up efforts, assist the polluter if their resources aren't adequate, or direct the cleanup if the operator is unable or unwilling to respond to the spill.

Arctic Regional Environmental Emergencies Team (Arctic REET) is an interagency committee that includes representatives from federal, territorial and Aboriginal organizations and is chaired by a representative of Environment Canada. The REET is to provide consolidated environmental advice to responsible agencies in the event of an oil spill. As mentioned above, this organization is required under the National Contingency Plan, which is a regulatory requirement under federal legislation.

⁶⁶⁶ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 24, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

⁶⁶⁷ Government of Canada, *Canada Oil and Gas Operations Act*, 1985, c. O-7, Section 25(3), <http://laws-lois.justice.gc.ca/eng/acts/O-7/FullText.html?term=response>.

⁶⁶⁸ *Ibid.*, Section 25(3).

⁶⁶⁹ *Ibid.*, Section 25(4).

⁶⁷⁰ This agreement is not a legislative requirement. It provides for coordination among government agencies. Other parties to the agreement include Transport Canada /Canadian Coast Guard, Indian and Northern Affairs Canada, Environment Canada, National Energy Board, Inuvialuit Land Administration, Government of the Northwest Territories, and the Government of Nunavut. *Northwest Territories/Nunavut Spills Working Agreement*, 2008, (available from the NEB upon request).

Environment Canada has a primary role in the Arctic REET as mentioned above, and may also provide information about weather and ice conditions to the operator and NEB.⁶⁷¹

Department of Fisheries and Oceans may provide information about location and potential impacts on fish and marine mammals in vicinity of the spill.⁶⁷²

Canadian Coast Guard would provide support and equipment to the NEB as part of the Arctic REET.⁶⁷³

8.2.2 United States

Operators are required by 30 CFR 254.5 to carry out the action identified in their OSRP in the event of release of oil from the facility. The implementation of the response plan is carried out by the Spill Management Team who is a group of personnel identified in the plan (either employees of the company or a contracted third party). Additional guidance for response is provided by a number of NTLs.⁶⁷⁴

BOEMRE is the main regulatory body for oil spill planning and response for offshore production offshore facilities (located seaward of the coast line).⁶⁷⁵ The authority to regulate is derived from the *Oil Pollution Act* of 1990 and Executive Order 12777.⁶⁷⁶ BOEMRE has primary responsibility for spill management and facility shutdown and/or startup.⁶⁷⁷ The *Clean Water Act* allows the federal government to step in and direct activities to remove or prevent a discharge if it is determined that there would be a substantial threat to the public health or welfare.⁶⁷⁸

Oil Spill Response Organizations (OSRO) are private companies that provide oil spill response services to operators under contract. It is the operators' ultimate responsibility to ensure that adequate personnel, material and equipment are available for response operations. The OSRO

⁶⁷¹ Indian and Northern Affairs Canada, *Working Together: What Government and Other Agencies do if Canadian Arctic Waters are Threatened by a Spill*, 2003, <http://www.ainc-inac.gc.ca/nth/og/pubs/wkto/wkto-eng.pdf>.

⁶⁷² Ibid.

⁶⁷³ Ibid.

⁶⁷⁴ U.S. Bureau of Ocean Energy Management, Regulation and Enforcement, *Notice to Lessees: Oil Spill Response Plan*, NTL No. 2009-P03, <http://www.gomr.boemre.gov/homepg/regulate/regs/ntls/2009NTLs/09-P03.pdf>; and *Notice to Lessees: Regional and Sub-Regional Oil Spill Response Plans*, NTL No. 2006-G21, <http://www.gomr.boemre.gov/homepg/regulate/regs/ntls/2006%20NTLs/06-g21.pdf>.

⁶⁷⁵ U.S. Minerals Management Service, *Memorandum of Understanding Establishing Jurisdictional Responsibilities for Offshore Facilities*, 1994 Fed. Reg. 9494, February 28, 1994, <http://www.boemre.gov/PDFs/FR9494.pdf>

⁶⁷⁶ President of the U.S., "Executive Order 12777, Implementation of Section 311 of the Federal Water Pollution Control Act of October 18, 1972, as Amended, and the Oil Pollution Act of 1990," (October 22, 1991), <http://www.boemre.gov/offshore/OilSpillProgram/Assets/PDFs/EO12777-OSP.pdf>

⁶⁷⁷ *Memorandum of Agreement between the Minerals Management Service—U.S. Department of the Interior and the U.S. Coast Guard—U.S. Department of Homeland Security: Oil Discharge Planning, Preparedness, and Response*, MMS/USCG MOA: OCS-03, May 23, 2007, <http://www.boemre.gov/regcompliance/MOU/PDFs/MOU-MMSUSGS-OilDischargeMOAMay232007.pdf>

⁶⁷⁸ "Clean Water Act: Oil and hazardous substance liability," U.S. Code of Federal Regulations Title 33, Pt. 1321(b)(4).

classification guidelines developed by the United States Geological Survey can be used to demonstrate that sufficient personnel, material and equipment are available.⁶⁷⁹

The National Response Team (NRT) is established by 40 CFR 300.110. The responsibilities of the NRT include planning and coordinating responses to major discharges of oil or hazardous waste, providing guidance to Regional Response Teams, coordinating a national program of preparedness planning and response, and facilitating research to improve response activities. EPA serves as the lead agency,⁶⁸⁰ and 14 other federal departments and agencies are involved.⁶⁸¹

Regional Response Teams (RRT) are established under 40 CFR 300.115, and are responsible for planning and coordinating regional preparedness. The RRT also provides oversight and consistency review for Area Contingency Plans within a given region. The RRT consists of representatives from the federal agencies involved in the NRT and state and local government.

The Federal On-Scene Coordinator (FOSC) is established under 40 CFR 300.120 and 40 CFR 300.135(a). The FOSC directs response efforts and coordinates all federal, state, and private response at the scene of a discharge or release. For offshore drilling, the OSC is provided by the U.S. Coast Guard.

Environmental Protection Agency (EPA) works with U.S. Geological Survey to coordinate the NCP preparedness and response activities. The EPA is the Chair of the NRT and co-chairs the RRTs with the U.S. Coast Guard.⁶⁸² The EPA provides expertise on effects of oil spills on human health, methods of risk assessment, pollution control techniques, and legal expertise on the interpretation of environmental statutes.⁶⁸³

U.S. Coast Guard (USCG) is the NRT vice chair, co-chairs the standing RRTs with the EPA, and is responsible for designating FOSCs.⁶⁸⁴ The USCG maintains facilities which can be used for command, control, and surveillance of oil discharges. The USCG provides expertise regarding safety and security, maritime law enforcement, and the manning, operation, navigation and safety of marine facilities.⁶⁸⁵

⁶⁷⁹ U.S. Coast Guard, *Guidelines for the U.S. Coast Guard Oil Spill Removal Organization Classification Program*, 2001, <http://ocean.floridamarine.org/acp/mobacp/PDF/TACTICAL/FinalOSROGuidelines.pdf>.

⁶⁸⁰ “National Response Team”, U.S. Code of Federal Regulations Title 40, Pt. 300.110.

⁶⁸¹ Other federal agencies include: U.S. Coast Guard, U.S. Department of Agriculture, U.S. Department of Commerce/NOAA, U.S. Department of Defence, U.S. Department of Energy, U.S. Department of Health and Human Services, U.S. Department of the Interior, U.S. Department of Justice, U.S. Department of Labour, U.S. Department of Transportation, Federal Emergency Management Agency, U.S. General Services Administration, U.S. Nuclear Regulatory Commission, and U.S. Department of State.

⁶⁸² “National Response Team,” U.S. Code of Federal Regulations Title 40, Pt. 300.110.

⁶⁸³ “Federal agencies: additional responsibilities and assistance,” U.S. Code of Federal Regulations Title 40, Pt. 300.175.

⁶⁸⁴ “On-scene coordinators and remedial project managers: general responsibilities,” U.S. Code of Federal Regulations Title 40, Pt. 300.120(a)(1).

⁶⁸⁵ “Federal agencies: additional responsibilities and assistance,” U.S. Code of Federal Regulations Title 40, Pt. 300.175.

Comparison to the Canadian Arctic Offshore

Similar to regulations for Canada's Arctic offshore, regulations in the U.S. place primary responsibility for response and clean-up on the operator, and the national government coordinates response and can intervene if there is a substantial threat to public health or welfare.

8.2.3 United Kingdom

Operators must immediately report any spill to the HSE,⁶⁸⁶ Her Majesty's Coast Guard⁶⁸⁷ and the DECC. They must implement the actions outlined in the OPEPs.⁶⁸⁸

Department of Energy and Climate Change (DECC) is responsible for regulation of offshore installations. DECC requires that all oil and chemical spills, irrespective of volume, be reported within six hours of the accident occurring, or within one hour if the release is over one tonne.⁶⁸⁹

Maritime and Coastguard Agency (MCA) is the primary response agency to offshore pollution from shipping and offshore installations. It organizes and implements response according to the National Contingency Plan.⁶⁹⁰

Her Majesty's Coast Guard (HMCG) provides communications, marine safety information broadcasts, search and rescue and knowledge of the area.⁶⁹¹

Counter Pollution & Salvage Officer (CPSO) assesses the incident and assumes responsibility for salvage, arranges to deploy equipment, liaises with operators and can activate a larger-scale response in the event of a major spill.⁶⁹²

Secretary of State's Representative (SOSREP) is an appointed federal representative, established under the *Offshore Installations (Emergency Pollution Control) Regulations 2002*. This representative has powers to intervene "in the event of an incident or accident involving an offshore installation where there is, or may be a risk of, significant pollution, or where an operator is failing or has failed to implement effective control and preventative operations."⁶⁹³

⁶⁸⁶ Government of the U.K., *Dangerous Occurrences, The Reporting of Injuries, Diseases and Dangerous Occurrences Regulations 1995*, Statutory Instruments 1995, No. 3163, Schedule 2(21), <http://www.legislation.gov.uk/ukxi/1995/3163/schedule/2/made>.

⁶⁸⁷ Government of the U.K., *Merchant Shipping (Oil Pollution Preparedness, Response and Co-operation Convention) Regulations 1998*, Statutory Instruments 1998, No. 1056, Section 5, <http://www.legislation.gov.uk/ukxi/1998/1056/made#f00002>.

⁶⁸⁸ Ibid, Section 8.

⁶⁸⁹ Government of the U.K., *Memorandum submitted by the Department of Energy and Climate Change, Health & Safety Executive, and Maritime and Coastguard Agency*, Section 37, <http://www.publications.parliament.uk/pa/cm201011/cmselect/cmenergy/450/450we10.htm>.

⁶⁹⁰ U.K. Maritime and Coastguard Agency, *National Contingency Plan For Marine Pollution From Shipping And Offshore Installations*, 2000, <http://www.dft.gov.uk/mca/mcga-contin.pdf>.

⁶⁹¹ Ibid.

⁶⁹² Ibid.

⁶⁹³ Government of the U.K., *The Offshore Installations (Emergency Pollution Control) Regulations 2002*, Statutory Instruments 2002, No. 1861, <http://www.legislation.gov.uk/ukxi/2002/1861/contents/made>.

Comparison to the Canadian Arctic Offshore

As found in Canada's Arctic offshore regulations, the U.K. regulations place primary responsibility for response and clean-up on the operator, and the national agencies/representatives coordinate response (Maritime and Coastal Agency) and can intervene if there is a threat of significant pollution (the Secretary of State's Representative).

8.2.4 Greenland

Operators are required by section 64(1) of the *Mineral Resources Act* to take “any practically feasible measure that can limit the scope of the damage and prevent any further damage” in a case where it seems a spill may be likely. They are required to notify the government of the situation and any measures taken. The operator has final responsibility for abating and cleaning up after an oil pollution event.⁶⁹⁴

The Bureau of Minerals and Petroleum (BMP) is the lead regulatory agency in emergency situations that involve a significant release of hydrocarbons on offshore facilities. The BMP investigates reported incidents to determine factors leading to an incident, whether any trends are evident, and what action is necessary to prevent similar occurrences in the future.⁶⁹⁵

The Greenland Government must supervise the operator to ensure that they are performing their duties in the event of a spill, and may issue binding enforcement notices to provide information of importance of an assessment of existing or potential environmental damage.⁶⁹⁶ If there is a threat of injury, death, serious pollution or major damage, the Government can choose to establish or extend ‘safety zones’ or establish new zones in the spill region, which limit access to the area.⁶⁹⁷ The Greenland Government is also responsible for the setting up the emergency committee (below) that supervises and coordinates response.

Emergency Preparedness Facility (Committee) is required under the *Mineral Resources Act*, and establishes coordination of the action of authorities in the event of accidents and emergencies on offshore facilities. The emergency preparedness facility consists of: the Police, the Greenland Command, the Danish Maritime Authority, the Danish High Commission in Greenland, and the BMP.⁶⁹⁸

Comparison to the Canadian Arctic Offshore

Like Canada's Arctic offshore regulations, Greenland places primary responsibility for response and clean-up on the operator and a national body coordinates the government response to a spill.

⁶⁹⁴ Greenland Bureau of Minerals and Petroleum, *Exploration and exploitation of hydrocarbons in Greenland Strategy for Licence Policy*, 2009, http://www.bmp.gl/images/stories/about_bmp/publications/hydrocarbon_2009_uk.pdf.

⁶⁹⁵ Greenland Bureau of Minerals and Petroleum, “Emergency Response,” <http://www.bmp.gl/petroleum/emergency-response>

⁶⁹⁶ Greenland Self Government, *Greenland Parliament Act of 7 December 2009 on Mineral Resources and Mineral Resource Activities (The Mineral Resources Act)*, Section 64(2), http://www.bmp.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf.

⁶⁹⁷ *Ibid.*, Section 14(6).

⁶⁹⁸ Greenland Bureau of Minerals and Petroleum, *Exploration and exploitation of hydrocarbons in Greenland*.

Unlike Canada's Arctic offshore, the legislation does not give the national government widespread authority to intervene to direct response beyond establishment of safety zones and issuance of enforcement notices.

8.2.5 Norway

Operators are required under of the *Pollution Control Act* to initiate measures to avoid or limit damage and nuisance in the event of a spill,⁶⁹⁹ and to mitigate any damage or nuisance resulting from the pollution or from measures to counteract it.⁷⁰⁰ Once it is determined that action management is required, the emergency response plan must be available within one hour⁷⁰¹ and operators must notify the police immediately.⁷⁰² Section 77 of the *Activities Regulations* requires the owner/operator to implement response measures as close to the source of pollution as possible and to ensure that the situation can be normalized after the emergency has stopped (through monitoring and restoration of the environment).⁷⁰³

Norwegian Coastal Administration (NCA) is responsible for the overall coordination of state pollution contingency under the *Pollution Control Act*.⁷⁰⁴ The NCA also has the authority to coordinate all contingency organizations into one national emergency response system.

Section 46 of the *Pollution Control Act* allows municipalities or the pollution control authority to intervene if adequate action is not being taken by the operator. The act also allows the creation of an action control group that consists of representatives of authorities, which can assume command of operations if necessary.⁷⁰⁵

Comparison to the Canadian Arctic Offshore

Like in Canada's Arctic offshore regulations, Norway regulations place primary responsibility for response and clean-up on the operator and a national body coordinates response. Similar to Canada, the national pollution control agency can assume control of operations if deemed necessary. In addition to this, municipal governments also have power to intervene.

⁶⁹⁹ Government of Norway, *Act of 13 March 1981 No.6 Concerning Protection Against Pollution and Concerning Waste (Pollution Control Act)*, 1981 No.6, Section 46, <http://www.regjeringen.no/en/doc/Laws/Acts/Pollution-Control-Act.html?id=171893>.

⁷⁰⁰ *Ibid.*, Section 7.

⁷⁰¹ Petroleum Safety Authority Norway, , *Regulations Relating to Conducting Petroleum Activities (The Activities Regulations)* 2008, Section 79, <http://www.ptil.no/activities/category399.html>.

⁷⁰² Government of Norway, *Pollution Control Act*, Section 39.

⁷⁰³ Petroleum Safety Authority Norway, *Activities Regulations*, Section 77.

⁷⁰⁴ Government of Norway, *Pollution Control Act*, Section 43.

⁷⁰⁵ *Ibid.*, Section 45.

8.3 Capacity for response

8.3.1 Canadian Arctic Offshore

Canada's National Energy Board requires that operators ensure that spill containment products are both readily available and stored in sufficient quantities to respond to "reasonably foreseeable" emergency conditions, and these products must be stored and handled in a way that ensures safety and prevents pollution.⁷⁰⁶

8.3.2 United States

The U.S. requires that operators have the capacity to respond to a Worst Case Discharge Scenario (WCD) spill. The WCD is calculated based the sum of: daily production volume from an uncontrolled blowout of the highest capacity well associated with the facility, the maximum capacity of all oil storage on the facility, and the estimated volume of oil that would leak from a break in any attached pipeline.⁷⁰⁷ Operators are then required to calculate the effective daily recovery capacity of the response equipment that would be used to contain and recover the WCD scenario.⁷⁰⁸ Effective daily recovery capacity is calculated by multiplying the manufacturer's rated throughput capacity over a 24-hour period by 20% which is intended to take into account environmental factors that may impact the ability to recover the oil.⁷⁰⁹ Operators are required to consider the WCD scenario in adverse weather conditions.⁷¹⁰

Comparison to the Canadian Arctic Offshore

The U.S. uses a worst-case scenario multiplied by 20% as compared to the regulations for operators in the Canadian Arctic offshore to address the 'reasonably foreseeable' emergency conditions scenario.

8.3.3 United Kingdom

As part of their response plan, operators are required to list all hydrocarbons present on the facility along with their dispersion characteristics; identify potential scenarios which could cause

⁷⁰⁶ Government of Canada, *Canada Oil and Gas Drilling and Production Regulations*, 2009, SOR/2009-315, Section 22, <http://laws-lois.justice.gc.ca/eng/regulations/SOR-2009-315/FullText.html>.

⁷⁰⁷ "Exercises for your response personnel and equipment," U.S. Code of Federal Regulations Title 30, Pt. 254.47.

⁷⁰⁸ "What information must I include in the "Worst case discharge scenario" appendix?" U.S. Code of Federal Regulations Title 30, Pt. 254.26.

⁷⁰⁹ "Calculating response equipment effective daily recovery capacities," U.S. Code of Federal Regulations, Pt. 254.44.

⁷¹⁰ What information must I include in the "Worst case discharge scenario" appendix?," U.S. Code of Federal Regulations Title 30, Pt. 254.26.

a spill; and estimate the volume and severity of these possible spills.⁷¹¹ OPEPs are developed using a worst-case scenario based on probable risk.⁷¹²

Guidelines contain performance goals for response that operators must meet⁷¹³ based on a three-tier classification system:⁷¹⁴

- Tier 1 incident: requires resources to be available locally to be deployed as quickly as possible.
- Tier 2 incident: local resources may be insufficient to deliver a proper response and regional resources may be required, which can be deployed within 2 to 6 hours.
- Tier 3 incident: resources supplied from national and international sources may be required which must be deployed within 6 to 18 hours.

Operators must identify the necessary equipment, personnel, and actions in order to meet these time requirements for response. For installations within 25 miles of the coast, there are additional requirements regarding the use of dispersant and the time for response during certain conditions, and a shoreline protection strategy must be developed.⁷¹⁵ Operators are also asked to develop their response plan in a way that allows the response to be escalated in deteriorating conditions.⁷¹⁶

Comparison to the Canadian Arctic Offshore

The U.K. is similar to the Canadian Arctic offshore in that it uses probability to estimate required capacity. Unlike in the Canadian Arctic offshore, the U.K. has time-response requirements for multiple levels of spill severity.

8.3.4 Greenland

In Greenland, the *Mineral Resources Act* requires that operators assess and reduce risk.⁷¹⁷ Greenland's Licence Policy differentiates between minor spills and major spills, where minor

⁷¹¹ U.K. Department of Energy and Climate Change, *Oil Pollution Emergency Plan Requirements*, 2009, https://www.og.decc.gov.uk/environment/OPEP_Guidance.doc

⁷¹² Ibid.

⁷¹³ Ibid.

⁷¹⁴ The three-tier system is applied internationally. Industry organizations that have the capacity to respond to a Tier 3 spill have combined efforts globally to form the Global Response Network:

<http://www.globalresponsenetwork.org/home.htm>. Most jurisdictions reviewed here have an organization with the capacity to respond to a Tier 3 spill: Norway (NOFO,

http://www.nofo.no/modules/module_123/proxy.asp?D=2&C=107&I=349) U.K. and Greenland (www.oilspillresponse.com), and U.S. (Alaska Clean Seas www.alaskacleanseas.org, and Marine Spill Response Corporation www.msrg.org).

Canada has Tier 3 response capacity below 60° latitude. (http://www.ecrc.ca/en/can_ro/gar.asp) but there are no specialist Tier 3 response organizations north 60° latitude.

⁷¹⁵ U.K. Department of Energy and Climate Change, *Oil Pollution Emergency Plan Requirements*, 2009.

⁷¹⁶ Ibid.

⁷¹⁷ Greenland Self Government, *Greenland Parliament Act of 7 December 2009 on Mineral Resources and Mineral Resource Activities (The Mineral Resources Act)*, Section 79,

http://www.bmp.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf

spills are small enough to be cleaned up by equipment located on site or at a central location, and major spills require efforts from both onhand resources and efforts from international emergency response companies and spill response authorities in other jurisdictions.⁷¹⁸

There are no requirements as to what quantity or type of equipment must be kept on site to deal with a minor or major spill, though operators would be required to identify the type and location of equipment as part of the development of their Emergency Response Plan.⁷¹⁹ Furthermore, additional requirements for response capacity can be specified in a licence or an approval letter from the Bureau of Minerals and Petroleum.

Comparison to the Canadian Arctic Offshore

Unlike the regulations for the Canadian Arctic offshore, Greenland has no minimum requirements for response capacity from the operator. Instead, response capacity would have to be accepted by the regulator as part of the application for the project approval unless specifically addressed in a licence or an approval letter.

8.3.5 Norway

Norway uses a risk-based approach to response, requiring that spill response capacity be proportional to the probability of pollution and damage from an oil spill.⁷²⁰ This estimate of probability is based on an environmental risk analysis and the oil spill emergency preparedness analysis.⁷²¹

Equipment identified for response must be specifically adapted to the pollution's physical and chemical properties.⁷²² Guidelines state that materials should be “functional, robust, flexible and adapted in order to function effectively under prevailing weather, wind and current conditions in the entire area influenced by the pollution.” The guidelines also state that materials should be stored so that they can be mobilized at any given time in accordance with the emergency preparedness plan.⁷²³

⁷¹⁸ Greenland Bureau of Minerals and Petroleum, *Exploration and exploitation of hydrocarbons in Greenland Strategy for Licence Policy*, 2009,

http://www.bmp.gl/images/stories/about_bmp/publications/hydrocarbon_2009_uk.pdf.

⁷¹⁹ Greenland Bureau of Minerals and Petroleum, *Exploration Drilling Guidelines*, 2010, Section 1.1,

http://www.bmp.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf.

⁷²⁰ Government of Norway, *Act of 13 March 1981 No.6 Concerning Protection Against Pollution and Concerning Waste (Pollution Control Act)*, 1981 No.6, Section 49, <http://www.regjeringen.no/en/doc/Laws/Acts/Pollution-Control-Act.html?id=171893>.

⁷²¹ Petroleum Safety Authority Norway, *Regulations Relating to Management and the Duty to Provide Information in the Petroleum Activities and at Certain Onshore Facilities (The Management Regulations)*, Section 17, <http://www.ptil.no/management/category401.html>.

⁷²² Petroleum Safety Authority Norway, *Regulations Relating to Design and Outfitting of Facilities, etc. in the Petroleum Activities (The Facilities Regulations)*, 2010, Section 42, <http://www.ptil.no/facilities/category400.html>.

⁷²³ Petroleum Safety Authority Norway, *Guidelines Regarding The Facilities Regulations*, 2010, Section 42, <http://www.ptil.no/facilities/category405.html#p19>.

Comparison to the Canadian Arctic Offshore

Norway's regulations differ from the regulations for the Canadian Arctic offshore in that response capacity is based on a risk analysis, and there are stipulations in the regulations about adapting response equipment to the type of pollution and the site-specific conditions of each facility.