

AOOGG: Systems Safety Management and Safety Culture-Report, final version Feb 21, 2014
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Arctic Offshore Oil and Gas Guidelines: Systems Safety Management and Safety Culture

Avoiding Major Disasters in Offshore Oil and Gas Operations

prepared by the Protection of the Arctic Marine Environment Working Group
under the auspices of the ARCTIC COUNCIL

Arctic Offshore Oil and Gas Guidelines: Systems Safety Management and Safety Culture

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FOREWORD

The Arctic Offshore Oil and Gas Guidelines: Safety Management Systems and Safety Culture, was organized as a project under the Protection of the Arctic Marine Environment (PAME) Working Group of the Arctic Council. The project was led by the United States.

The work was reviewed and comments received at the biannual meetings of the PAME Working Group and two expert workshops in Keflavik, Iceland in June 2012, held jointly with the Recommended Practices for Prevention of Pollution (RP3) workshop by the Emergency Preparedness, Prevention and Response (EPPR) Working Group, and in Halifax, Nova Scotia, Canada in September 2012. Written comments were received from many individuals and organizations.

The current draft was circulated widely to Arctic Council National Governments, Permanent Participants and Observers, as well as academia, non-profit environmental and industry associations, and other stakeholders and has also had the benefit of editing by a professional writer/editor.

Glossary of Acronyms Used

AMAP	Arctic Monitoring and Assessment Program Working Group of the Arctic Council.
AMSA	Arctic Marine Shipping Assessment, 2009.
AOGCC	Alaska Oil and Gas Conservation Commission.
AOOGG	Arctic Offshore Oil and Gas Guidelines, 2009. PAME
AOPPR Agreement	Agreement on Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic, 2013.
AOR	Arctic Ocean Review, Phase I (2011) and Phase II (2013), PAME
API	American Petroleum Institute
ASAP	National Aeronautics and Space Administration's Aviation Safety Action Program
ASRS	Federal Aviation Administration's Aviation Safety Reporting System
BMP	Bureau of Minerals and Petroleum, Greenland.
BSEE	Bureau of Safety and Environmental Enforcement of the United States Department of the Interior.
DnV	Det Norske Veritas
EPPR	Emergency Prevention, Preparedness, and Response Working Group of the Arctic Council.
EUOAF	European Union Offshore Authorities Forum
FAA	Federal Aviation Administration
GMEP	G20 Global Marine Environment Protection Working Group
HSE	Health, Safety and Environment
IADC	International Association of Drilling Contractors
ICRARD	International Committee on Regulatory Research and Development
IRF	International Regulators Forum
ISO	International Organization for Standardization
MLSA	Mineral License and Safety Authority of Greenland
NASA	National Aeronautic and Space Administration
NEB	National Energy Board of Canada
NORSOK	Norwegian Industry Standards.
NSOAF	North Sea Offshore Authorities Forum
OGA	AMAP Assessment 2007: Oil and Gas Activities in the Arctic: Effects and Potential Effects, 2010.
OGP	International Association of Oil and Gas Producers
OSPAR	Oslo-Paris Convention for Protecting the Marine Environment of the North-East Atlantic
PAME	Protection of the Arctic Marine Environment Working Group of the Arctic Council
RBLC	Risk Based Life Cycle regulatory approach
RP3	Recommended Practices for Arctic Oil Spill Prevention, 2013. EPPR
RP	Recommended Practice
SARA Agreement	Agreement on Cooperation on Aeronautical and Maritime Search and Rescue in the Arctic, 2011.
SEMS	Safety and Environmental Management System.
SINTEF	An independent research organization in Scandinavia.
SMS	Safety Management System.
TC67 SC8	ISO Technical Committee 67 (Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries), Subcommittee 8 (Arctic Operations).

EXECUTIVE SUMMARY

Interest in Arctic offshore petroleum resources and anticipation of increased activities in the region continues to grow. As a result, there has also been a growing concern about the potential effects an increase in these activities might have on the Arctic marine environment and its communities. These concerns grew even more acute following the Macondo Well (Deepwater Horizon) oil spill in the Gulf of Mexico which occurred April 10, 2010. This ‘blowout’ lasted nearly 90 days before being capped. The tragedy of 11 lives lost and over 200 million gallons of crude oil that leaked into the Gulf made it the largest accidental marine oil spill in history. The economic, environmental and social impacts of this disaster are still being felt by many communities around the Gulf. If an incident such as what happened with the Deepwater Horizon/Macondo well were to occur in the Arctic offshore, the outcome could be much worse than the devastating effects on the people and ecosystems of the Gulf of Mexico and beyond.

Recognizing that governments have a role to play in both regulating and influencing the safety of oil and gas operations in the Arctic, the Protection of the Arctic Marine Environment (PAME) Working Group, prepared the current report. Its purpose is to provide more targeted guidance on protecting the marine environment from major accidents by improving safety management systems and safety culture in Arctic offshore petroleum operations. To that end, in preparing the current guide, PAME drew on the investigations and recommendations from the Deepwater Horizon accident (as well as numerous other investigations and hearings) and two specific workshops where international experts from governments, various industries, academia, indigenous peoples organizations, and other Arctic stakeholders were brought together for presentations and discussions.

The first workshop was on Health, Safety and Environment (HSE) Management Systems held in Keflavik, Iceland during June 10-12, 2012. It focused on the Deepwater Horizon accident and lessons learned that would translate to Arctic operations as well as health, safety and environment (HSE) management system requirements and recent changes in regulatory regimes in selected Arctic countries. The second workshop was on Safety Culture and was held in Halifax, Nova Scotia, Canada, September 16, 2012. The issue of safety culture was clearly identified as a priority for attention. The associated issues, challenges and suggested actions for creating and improving a positive ‘safety culture’ are examined more closely early in Section 7 and in Appendix F. The current guide includes a separate section on regulatory regimes and standards around the Arctic (Section 6), and additional information in Appendices A, E and G as well as in the online support document Table of Safety Systems Elements in Regulations of Norway, Canada, Greenland and the United States, and of the PAME AOOGG 2009 (www.pame.is).

This current guidance document was intended to enhance and supplement the 2009 Arctic Council’s Arctic Offshore Oil and Gas Guidelines (AOOGG), by focusing on providing tools and approaches for reducing the threat of catastrophic effects of major oil and gas related accidents, such as the 2010 Deepwater Horizon disaster.

Besides the issues of Coordination of Regulators and Safety Culture, the areas recommended for safety systems management guidance in the current report have been more focused and limited to the following nine (9) categories:

- **Continuous Improvement**
- **Risk Assessment/Hazard Identification**
- **Management of Change**
- **Training and Competence for Arctic**
- **Accountability and Responsibility**
- **Operating Procedures**
- **Quality Assurance/Mechanical Integrity**
- **Documentation and Reporting**
- **Communication**

Section 7 of the current guide elaborates on each of these safety system elements by outlining some key issues and challenges as well as some recommended actions or approaches that regulators should pursue to bring about improved system safety when regulating or influencing the safety of oil and gas operations in the Arctic. The reader is also encouraged to examine the numerous other reference studies and initiatives underway (listed in Appendices and online supporting documents) in order to have a more complete understanding and “toolkit” for exercising regulatory responsibilities toward a safer and more robust Arctic offshore oil and gas safety management system.

Arctic Offshore Oil and Gas Guidelines: Safety Management Systems and Safety Culture

1. Introduction, Background & Context

1.1 Introduction

The Arctic Council¹ is a high level intergovernmental forum that was established in 1996. Its aim is to address issues faced by Arctic governments and their indigenous peoples through cooperation, coordination and interaction among the member states. Since its formation in 1996, the Council has promoted sustainable development and environmental protection in the Arctic and, more specifically, has developed guidance for offshore oil and gas operations².

Interest in Arctic offshore petroleum resources and anticipation of increased activities in the region continues to grow. There has also been a growing concern about the potential effects an increase in these activities could have on the Arctic marine environment and the way of life of indigenous people and local communities. It is within that context that the Protection of the Arctic Marine Environment (PAME) Working Group prepared the current report to provide more focused guidance on protecting the marine environment from major accidents by improving safety management systems and safety culture for Arctic offshore petroleum operations. This report was developed to supplement and complement the earlier 2009 *Arctic Offshore Oil and Gas Guidelines* (AOOGG) (discussed further under Section 1.2 Project Background).

In the offshore oil and gas industry, safety management systems and safety culture are primarily defined, implemented, monitored, and controlled by the operator. Nevertheless, governments and regulators also play a key role in influencing improved performance and positive safety culture. Regulators must understand and communicate to the operator what management systems goals must be achieved to ensure systems safety compliance and help establish what expectations and behavior constitute a “positive safety culture.” The regulator must also be prepared to assess, measure and validate such benchmarks. The discussion and guidance provided in this report serve to identify some of the areas that are under the control of Arctic regulators and the measures governments can take to improve systems safety and safety culture in the industry while operating in the Arctic offshore.

While there are certainly some differences in substance and approaches to implementation, there are many common requirements across Arctic nations regarding safety management systems employed by offshore operators. Some of these common elements are evident in a comparison of the regulatory regimes of Norway, Greenland, Canada and the United States³ (outlined in a Table of Safety Systems Elements in Regulations of Norway, Canada, Greenland and the United States, and of the PAME AOOGG 2009 found in the supporting documents to this report on the PAME website at www.pame.is). This report does not pass judgment on the adequacy of these regulations nor identify gaps. Rather it attempts to provide a basis for understanding the

¹ Arctic Council member states include Canada, Denmark, Finland, Iceland, Norway, Russia, Sweden, and the United States – see also www.arctic-council.org/

² *Arctic Offshore Oil and Gas Guidelines* (AOOGG) 2009a update – Protection of the Arctic Marine Environment Working Group

³ Comparable information on regulations governing safety systems for Russia, Faroe Islands and Iceland were not available to PAME for this table.

processes and approaches used by the various national governments and the roles they can play in preventing a major offshore accident in the Arctic.

This report examines the importance of “Safety culture” and “regulatory coordination” in Section 7 and highlights nine (9) regulatory elements of safety management systems and uses them as guidance to improve the supervision of the industry’s safety and environmental performance. These nine elements include (discussed in detail in Section 7): Continuous Improvement, Risk Assessment/Hazard Identification; Management of Change; Training and Competence for Arctic; Accountability and Responsibility; Operating Procedures; Quality Assurance/Mechanical Integrity; Documentation and Reporting; and Communications. Appendix A contains Table A1 summarizing the regulations requiring and governing the implementation of these Safety Systems Management elements in Norway, Canada, Greenland and the United States). The role of “regulations and standards” is discussed in Section 6.

1.2 Project Background

Arctic Council Ministers⁴ recognized in 1996 that oil and gas operations in the Arctic offshore pose potential harmful effects to the marine environment. PAME was subsequently tasked to develop “*guidelines for offshore petroleum activities in the Arctic, in particular guidelines for timely and effective measures for protection of the Arctic environment*”. The resulting *Arctic Offshore Oil and Gas Guidelines* (AOOGG) document was written initially in 1997 and was subsequently updated in 2002 and 2009. These updates responded to the requirement that the Guidelines “*undergo periodic review and amendment*” and reflected new activities, experiences and regulatory changes that have occurred since the original document was written.

In preparing the Guidelines and its updates, PAME benefitted significantly from input from the Emergency Prevention, Preparedness and Response Working Group (EPPR), the Arctic Monitoring and Assessment Program Working Group (AMAP), as well as input and comments from a wide range of representatives from Arctic governments, non-governmental organizations, industry, indigenous people, and the scientific community. With further significant changes evident in industry, regulatory regimes, rules, and in the public’s perception of offshore oil and gas activities since the 2009 update, PAME developed the current report. This current guidance document was intended to enhance and supplement the 2009 AOOGG guidelines by focusing on providing tools and approaches for reducing the threat of catastrophic effects of major oil and gas related accidents, such as the 2010 Deepwater Horizon disaster.

The title of the original project proposal as approved by the Ministers in 2011 was “*Health Safety and Environmental Management Systems and the Use of Best Operating Practices for Offshore Arctic Oil and Gas Drilling Activities*”⁵. As the project proceeded, the issues became more focused. Drawing on the results of various investigations of the Deepwater Horizon accident and several Arctic regulatory hearings and reorganizations, as well as specific workshops, the project scope was further refined. Changes included giving more prominence to the importance of safety culture (dedicated workshop in September 2012), broadening the scope to the full range of

⁴ Report of the Third Ministerial Conference on the Protection of the Arctic Environment (Inuvik, Canada, March 20-21, 1996) - (Paragraph 2.3.5(ii)).

⁵ PAME Work Plan 2011-2013, www.pame.is

operations and not limiting it to “drilling activities”, and subsuming “best operating practices” into the overall management systems and safety culture of an operating company. Shortly after approval of the current project, Arctic Ministers also directed the Emergency Prevention, Preparedness, and Response (EPPR) Working Group to develop best practices/recommendations for the prevention of oil pollution⁶.

With the benefit of two workshops, it became clear that the report title should be changed to more accurately reflect the scope of the final findings and recommended guidance. Therefore, the draft report title was changed to “*Arctic Offshore Oil and Gas Guidelines: Systems Safety Management and Safety Culture.*”

1.3 Context

Fortunately, major offshore oil and gas accidents are still relatively rare events. However, when they have occurred they have all too often had critical consequences with human casualties, fires and explosions, sinkings, and environmental disasters. Investigative reports on recent blowouts such as the Montara well in the Timor Sea northwest of Australia⁷ and the Macondo well⁸ in the Gulf of Mexico, have identified failures in the Operator’s safety management systems with human and organizational factors including a lack of “safety culture,” as root causes of the specific problems that led to these blowouts.

Investigations of the Deepwater Horizon/Macondo well incident yielded many urgent recommendations for improving safety in the offshore oil and gas industry and avoiding future major accidents (See Appendices B and E). Among the many underlying causes discovered for this particular disaster and other major accidents such as the Montara well blowout failures of safety management systems and a lack of a positive safety culture are the most prominent. Both industry and regulators have been working to implement many of these recommendations to improve safety and environmental performance in offshore operations since the accident in April 20, 2010. However, the process of improvement is never finished, and industry and regulators must always be vigilant and avoid any complacency that might set in and erode safety culture and undermine safety and environmental protection. The findings and guidance of this report are relevant and compelling reminders for Arctic states to continuously strengthen and improve their regulation and enforcement of Arctic offshore operations for the protection of the marine environment.

In the aftermath of the Deepwater Horizon/Macondo well accident in the spring and summer of 2010, the Arctic Council began to re-evaluate the need for further guidance on Arctic offshore oil and gas activities.

⁶ The Emergency Prevention, Preparedness and Response (EPPR) Working Group has subsequently published the *Recommended Practices for Arctic Oil Spill Prevention*. (EPPR, 2013a);

⁷ Montara – Timor Sea oil spill off the coast of Australia began following a blowout on August 21, 2009 and the leak lasted 74 days. Estimates (Australian [Department of Resources, Energy and Tourism](#)) placed the leak in excess of 200 barrels per day;

⁸ Macondo Well (Deepwater Horizon) oil spill in the Gulf of Mexico occurred April 10, 2010 and lasted nearly 90 days before being capped. In addition to the tragedy of 11 lives lost, over 200 million gallons of crude oil leaked into the Gulf making it the largest accidental marine oil spill in history.

Shortly after the Macondo well was capped on July 12, 2010, after nearly 90 days of uncontrolled flow of hydrocarbons, the PAME Working Group began to review the guidance for protection of the Arctic marine environment from negative effects of offshore oil and gas operations contained in the AOOGG (note: guidance that was two years in the making and only one year old at the time of the accident). After that review, it was clear that the basic guidance was still pertinent and valid. However, in light of what was already known about the causes of the Deepwater Horizon accident at that time, the review found that there was a need for a more in-depth look at certain aspects of safety management systems employed in Arctic operations and a need for PAME to emphasize and supplement guidance beyond what was last published in the AOOGG.

A tremendous amount of literature, research and guidance documents exist for developing, maintaining and improving safety management systems for oil and gas and other industries (See Appendix D; HSE Guidance for a bibliography of documents). The reader is encouraged to consult the many other documents included in the Reference section and online supporting documents (www.pame.is) to this report as well the listing in Appendix D.

2. Purpose, Scope & Format of Guide

2.1 Purpose

This report, first and foremost, tries to establish a common understanding of the goals and processes for managing major risk elements and preventing pollution of the Arctic marine environment from major accidents during offshore oil and gas operations. The report also outlines targeted actions or approaches which can act to guide Arctic national and regional authorities in regulating (or influencing) the critical human and organizational safety systems that form part of the complex offshore operations in the Arctic. The better understanding of risk management and targeted guidance recommendations (embraced and implemented) should help prevent major disasters that could be so devastating in the sensitive Arctic marine environment.

The guidance in this document, therefore, is primarily aimed at what Arctic countries can do to promote improved safety culture and robust safety management systems in the industry it regulates.

The guidance is meant to supplement and enhance guidance contained in the Arctic Council 2009 *Arctic Offshore Oil and Gas Guidelines* (AOOGG) (PAME 2009a) and more broadly, recommendations of the report on *Recommended Practices for Arctic Oil Spill Prevention* (RP3) (EPPR 2013a), the Arctic Monitoring and Assessment Program (AMAP) *Assessment 2007: Oil and Gas Activities in the Arctic—Effects and Potential Effects* (OGA) (AMAP, 2010), and several other reports and guidelines of the Arctic Council. Appendix H contains a listing and Table A3 of various Arctic Council guidance documents and recommendations for offshore petroleum operations regarding safety management systems, safety culture, international standards and cooperation. Taken together these offer a more comprehensive roadmap to safer offshore operations in the Arctic.

2.2 Scope of Guide

Thirty safety system elements compiled from a review of safety system regulations in Norway, Canada, Greenland and the United States were considered initially (see www.pame.is for supporting online document: Table of Safety Systems Elements in Regulations of Norway, Canada, Greenland and the United States, and of the PAME AOOGG 2009). The pertinent regulations from Russia, Iceland and Faroe Islands were not available for this table. After discussions in the supporting workshops, the areas for recommended guidance in the report have been focused on and refined to the following nine (9) categories of safety management systems (See Appendix A Table A1):

- **Continuous Improvement**
- **Risk/Hazard Analysis**
- **Management of Change**
- **Training and Competence for Arctic**
- **Accountability and Responsibility**
- **Operating Procedures**
- **Quality Assurance/Mechanical Integrity**
- **Documentation and Reporting**
- **Communications**

Furthermore, the scope of activities addressed have been broadened to cover the entire range of offshore oil and gas operations and not be limited to “drilling activities”, as had been the case at the outset of the project.

Although the reader will note occasional references to Health, Safety and Environment (HSE) for the operator management systems in this report, for the most part, the report deals only with systems, or process safety, not occupational safety, per se. In addition, the report does not deal with the “H” or occupational health aspect. Nor does it deal specifically with routine environmental management issues such as waste handling and emissions. These aspects of HSE management are dealt with in the AOOGG (PAME, 2009a) and the OGA⁹ (AMAP, 2010). For the purposes of this guide, the reader should also note that whenever the text refers to ‘safety’ or ‘safety systems’, the idea of environmental protection is meant to be part of this whether explicitly mentioned or not.

2.3 Report Organization and Format

The substantive sections of this report are Sections 4 through 7 which starts by characterizing the challenging yet diverse operating environment presented by the Arctic in Section 4. Drawing on lessons learned (outlined in Section 5) and a review of some of the regulatory and standards regimes among Arctic states (Section 6), Section 7 begins by examining the over-arching importance of “safety culture” as underpinning much of the attitudinal and behavioural aspects of continuous vigilance and system improvement. The balance of Section 7 then focuses on the

⁹ *Oil and Gas Activities in the Arctic: Effects and Potential Effects* – published in 2010 under the guidance of the Arctic Monitoring and Assessment Program Working Group (AMAP); www.amap.no/oga

nine (9) target guidance areas for safety management systems. Here each topic or element begins with a statement of the issue, followed by a list of challenges, and finally ends with a set of recommended actions or approaches to be taken by regulators.

The appendices are included to add further detail and/or references, for example: information on selected Deepwater Horizon accident investigations and associated regulatory reforms, reviews, and reports presented at the workshops (Appendix B).

The appendices also contain background information including Table A1 (Appendix A) of selected Safety Management Systems requirements for some Arctic countries; Table A2 Deepwater Horizon accident investigations (Appendix C); a list of HSE and Safety Culture Guidance documents (Appendix D); a summary of what has been done recently in various Arctic countries with respect to offshore oil and gas safety management systems and safety culture (Appendix E); a further discussion on Safety Culture and Regulatory Coordination mechanisms in Appendix F & G respectively, and a listing of Arctic Council documents concerning offshore oil and gas activities and a comparison table (Table A3) of guidance or recommendations contained in each report for improving safety management, safety culture, cooperation, and international standards and practices is contained in Appendix H.

Supporting documents are posted on the PAME website (www.pame.is) and include a Table of Thirty Safety Systems Elements in Regulations of Norway, Canada, Greenland and the United States, and of the PAME AOOGG 20092; a Table of Recommended Actions or Approaches from the AOOGG Safety Systems Management and Safety Culture Report; and Reports for the HSE Management Systems and Safety Culture workshops.

3. Target Audience(s)

The information, references and guidance contained in this report will be useful to both management and safety practitioners in the offshore oil and gas industry. It will serve to clarify the perspectives that must be taken by regulators in overseeing and attending to the safe management and performance of oil and gas activities in offshore Arctic operations. As will be seen through the various sections, the pursuit of continuous safety vigilance and actions is seen as a collaborative effort between operators and regulators where mutual responsibilities must be communicated, plans must be implemented (not just left on paper), and information and data must be shared. However, it is primarily intended as a guidance tool for those more directly responsible for regulating, influencing and overseeing the safety of a broad range of activities associated with oil and gas exploration and production offshore in the Arctic.

4. The Challenging and Diverse Arctic Operating Environment

Arctic offshore operations are complex and often face extremely challenging conditions that may include sub-zero temperatures, sea ice and icing, remoteness and lack of infrastructure. Relatively short exploratory drilling seasons, darkness, sensitive environment and species, potential conflicts with other users of the ocean, and high operating costs, add further to these challenges. Nevertheless, the Arctic should not be considered as one homogeneous region. Operational conditions of Arctic offshore operations may differ vastly depending on, for

example, the ice conditions, water depths, and proximity to existing support infrastructure of the specific area and region. Given also that these Arctic operational conditions will vary by season and region, technology responses that are suitable under certain conditions may well be inappropriate in other circumstances or areas– in other words there can be no ‘one-size-fits all’ approach. These differences need to be considered when developing the best safety management systems.

When complex and varied systems (which also characterize Arctic offshore operations) fail, they likely fail in complex ways. Any and all of these Arctic conditions may be factors that contribute to risk of a systems failure. If an incident such as what happened with the Deepwater Horizon/Macondo well were to occur in the Arctic offshore, the outcome could be much worse than devastating effects on the people and ecosystems of the Gulf of Mexico and beyond.

In the Arctic,

- CASUALTIES could be higher because of more difficult evacuation, emergency response and rescue conditions;
- CAPPING could be more difficult in remote areas due to the limited availability of locally-based resources and contractor support, weather constraints getting to/from (and operating at) the site, etc.;
- CLEAN-UP may take longer or be less effective because of fewer supporting vessels and infrastructure as well as possible ice interference with removal techniques and equipment;
- ENVIRONMENTAL DAMAGE could be more extensive and/or longer lasting and more environmental damage could be done because of the fragile and sensitive nature of the environment and persistence of oil in cold temperatures;
- LOCAL COMMUNITIES could suffer harm as serious socioeconomic and cultural consequences would likely impact local communities that depend on the Arctic Ocean for their subsistence foods, cultural and traditional way of life.

The Arctic is a frontier area where some regions are characterized by specific physical environmental conditions, where technology and practices are pushing the limits of experience. This type of situation requires constantly evaluating and assessing the risk of system failures. Potential for such system failures exists as a consequence of the possibility of individual human error/misjudgment as well as organizational management system lapses. Safety management systems therefore have to be resilient enough to counter consequences of individual human or organizational breakdowns.

5. Lessons Learned from International Experience

5.1 Lessons Learned, Lessons Forgotten

Learning from major events, such as the Piper Alpha¹⁰ or the Deepwater Horizon accidents, tends to peak soon after the event and then starts to erode¹¹. Lessons are often learned by personal experience and kept alive by memories and by teaching others¹². When memories fade and personal experience is lost, lessons tend to be diluted, not passed on, or forgotten entirely. There are very few organized courses of study in engineering schools or industry management education programs that teach the next generations about systems safety and lessons learned from major accidents¹³. It is often taught and relearned only in the aftermath of another disaster occurring.

In the absence of any significant history of operations (and no major accidents) in the offshore Arctic, it becomes harder still to apply any `lessons learned`. It may, therefore, be necessary to draw from experience and lessons learned from major accidents in other offshore areas but also other sectors, such as aviation, nuclear, chemical, military, and others. In addition, lessons can be learned about improving safety systems from collecting, analyzing, and sharing data across the industry on trends in safety performance including the use of leading indicators.

Lessons learned should not all be from major accidents (lagging indicators) or worst-case scenarios, but should include trend analysis of performance using a combination of leading and lagging indicators such as incidents and near-misses, results of audits, worker questionnaires and surveys, records of safety meetings, and other documents.

Collective learning from sharing incident and near-miss data and analyses between operators and regulators is necessary to ensure that lessons learned are applied before an accident happens. This can be done by identifying hazards and trends in safety performance. It is also important to make near-miss and incident analyses public to foster transparency and help improve industry and regulator accountability.

The lessons from major incidents should constantly influence how operations are planned, carried out, supervised and monitored in the Arctic. In addition to all of the other regulatory permitting and monitoring activities that must be undertaken in Arctic operations, industry and regulators must also remain focused on the importance of not repeating the human and organizational mistakes of these systems failure accidents.

“Safety and environmental protection are not proprietary” (PC, 2011, p. 217).

5.2 Investigative Reports on Related Accidents

Investigations of recent major offshore oil and gas accidents have resulted in many findings and recommendations that are pertinent to Arctic offshore operations. The drilling of an ultra-deep water oil well, such as the one in the Macondo oil field, is an extremely complicated endeavor involving many interacting systems, processes and complex technology in an extreme environment. The reader is encouraged to consult the fuller listing of investigations of the

¹⁰ Piper Alpha platform in the North Sea had an explosion and fire in July 1988 in which 167 men perished. Regarded as the worst offshore oil disaster in United Kingdom history;

¹¹ (PAME, 2013b, p. 15)

¹² (PAME, 2013b, p. 27)

¹³ (PAME, 2013b, p 19)

Macondo Well/Deepwater Horizon and other related accidents contained in Appendix C to this report.

Studies have shown failure to effectively implement certain safety system elements may lead to major industrial accidents.

A study done by Det Norske Veritas (DNV) for the National Energy Board Canada's Arctic Drilling Review on causes of eight major industrial accidents showed failure in four main safety management systems elements¹⁴ :

- ***Disconnect in Policies vs. Plan--Do--Check--Act (Safety Culture)*** There was a notable disconnect between the company's vision and policies ('what they say') and their planning, implementation, monitoring and review ('what they do').
- ***Policy, Commitment and Planning.*** Policy and Commitment statements were present in all accidents but planning elements such as the following were deficient including:
 - hazard identification,
 - risk assessments, and
 - related controls
- ***Implementation.*** Management system elements common to all of the accidents included:
 - the lack of communications, documentation and document control,
 - poor operational control, and
 - inadequate management of change.
 - lack of adequate training
- ***Corrective Actions & Management Review.*** Checking and review elements are critical to ensuring continuous improvement within the system and the following factors contributed to all of the accidents:
 - deficient inspections and monitoring;
 - inadequate corrective and preventive actions to address identified deficiencies;
 - poor records management;
 - poor internal audits, and
 - lack of adequate management review.

In a Bureau of Safety and Environmental Enforcement-BSEE (U.S.) analysis of 1000 accident investigations in the U.S. Outer Continental Shelf¹⁵, failure to address at least one of the following safety management elements was found as a contributing factor or root cause in each of the 1000 incidents evaluated:

¹⁴ PAME Report – Findings and Recommendations of the Health, Safety and Environmental Management Systems Workshop – 2013a, pg 15;

¹⁵ PAME Report – Findings and Recommendations of the Health, Safety and Environmental Management Systems Workshop – 2013a, pg 21;

- Hazard Analysis
- Operating Procedures
- Quality Assurance and Mechanical Integrity
- Management of Change

The over-riding cause of the Macondo well blowout and ensuing disaster was failure of the operator to have an effective safety management system and positive safety culture. These findings are summarized in Appendix B. More recently, in the summer of 2012, after the development of this report was well underway, Shell launched a long anticipated drilling campaign in the Chukchi and Beaufort seas in the U.S. Arctic. Although, operations during the restricted¹⁶ drilling program were safely done, there were signs that Shell had problems related to the implementation of their safety and environmental management systems. After the *Noble Discoverer* drill ship arrived in southern Alaska from summer Arctic drilling operations for Shell in late 2012, a U.S. Coast Guard inspection found multiple deficiencies including that no audit records were available and crewmembers were not familiar with the safety management system¹⁷. The other vessel that drilled Shell's wells, the conical drill ship *Kulluk*, lost its tow-line in a storm in subarctic Alaska and ran aground. The U.S. Department of the Interior's report on Shell's overall 2012 operations found multiple failures or deficiencies in elements of their safety management system¹⁸ including documentation, management of change, integrated risk assessment, contractor management, mechanical integrity and planning. In addition there was limited attention paid to integrated planning or the overall operation.

A study by St. Mary's University (Canada) was presented to the National Energy Board (NEB) Arctic Drilling Review on major systems failure accidents. The study found that 14 out of 17 disasters examined contained cultural causes¹⁹ :

- Tolerance of inadequate systems and resources (identified 10 times);
- Acceptance of substantial departures from safety policy or processes (identified 9 times);
- Complacency (identified 8 times);
- Work pressure/cost (identified 4 times);

5.3 Outcomes of Relevant Workshop Discussions

Two offshore oil and gas workshops were held in support of this project. The full reports with all presentations and discussions are published separately by the PAME Working Group and are posted on the PAME website (www.pame.is) in the supporting documents for this report.

¹⁶ DOI, 2013 – Department of Interior Assessment of Shell's Arctic Drilling Program;

¹⁷ Markey Releases Massive Safety Violations for Shell's Arctic Drilling Ship, Showing Company May Have Sent Unsafe Ship to Drill, Natural Resources Committee Democrats, Feb 22, 2013
<http://democrats.naturalresources.house.gov/press-release/markey-releases-massive-safety-violations-shell-s-arctic-drilling-ship-showing-company>

¹⁸ The Department of Interior (DOI) Assessment of Shell's 2012 Arctic Drilling Program, 2013, pg 1;

¹⁹ PAME Report – Findings and Recommendations of the Health, Safety and Environmental Management Systems Workshop – 2013a, pg 14 and 2013b, pg 44

The workshops provided many recommendations--including that this report focus on certain elements of safety management systems that have been found to be at the core of major accidents. Of the many (often inter-related) elements that comprise safety systems (see online supporting document Table of Safety Systems Elements in Regulations of Norway, Canada, Greenland and the United States, and of the PAME AOOGG 2009), the following elements were selected as a sub-set for more guidance in the Arctic context for this report (See Appendix A Table A1):

- Continuous Improvement
- Risk Assessment/Hazard Identification
- Management of Change
- Training and Competence
- Accountability
- Operating Procedures
- Quality Assurance/Mechanical Integrity
- Documentation and Reporting
- Communication

The first workshop on Health, Safety and Environment (HSE) Management Systems was held in Keflavik, Iceland during June 10-12, 2012. The second workshop on Safety Culture was held in Halifax, Nova Scotia, Canada, September 16, 2012. Both of these workshops convened international experts from governments, various industries, academia, indigenous peoples organizations, and other Arctic stakeholders, for presentations and discussions.

The HSE Management Systems workshop featured discussions on;

- 1) investigations of the Deepwater Horizon accident and lessons learned that would translate to Arctic operations;
- 2) HSE management systems requirements of selected Arctic countries;
- 3) results of recent changes in Arctic regulatory regimes; and
- 4) various HSE elements that might need more focus in an Arctic context.

The issue of safety culture was also clearly identified as a priority, and warranted a separate workshop to explore further. The Safety Culture Workshop consisted of invited experts from various industries, government bodies, and academia who presented on the subject of “safety culture” as it applies to the prevention of systems/process failure accidents and pollution incidents.

It is clear from the two workshops that investigations of major industrial accidents, including offshore oil and gas disasters, show that they have similar root causes—deficiencies in safety management systems and poor safety culture. It is also clear that many lessons from these industrial accidents can and should be applied to Arctic offshore oil and gas operations.

The information from these workshops is central to PAME for the findings and guidance in this report. The findings and recommendations from the full workshop reports should also be read for possible ways to further improve safety performance in the Arctic offshore oil and gas sector.

6. Some Regulatory Regimes and Standards around the Arctic

6.1 Performance Based Regulations vs. Prescriptive Regulations

Issues and Considerations

In a performance-based or goal-setting system, regulators require explicit outcomes achieved via process, policy and/or procedures. These are established through a set of minimum standards or performance requirements for these processes, policies and procedures. Under such a performance-based regulatory approach, the responsibility and accountability for achieving safety and environmental protection is placed on the operator. It would appear to be the more appropriate regulatory approach for Arctic offshore operations because performance-based systems are more flexible, allowing new (and more effective) technology and practices to be adopted as they emerge.

A more prescriptive regime, on the other hand, with specific regulations and rules governing all aspects of operations, requires extensive experience of activities in order to build a detailed understanding of all the issues and methods. However, there is a relative lack of experience in the Arctic offshore to draw on for developing comprehensive and effective prescriptive regulatory regimes. As can be seen from Figure 1 (see Section 5), Arctic drilling history is relatively sparse and peaked in the 1980's. Compared to the tens of thousands of offshore wells drilled in the Gulf of Mexico, where the Deepwater Horizon accident occurred, there is relatively little Arctic offshore experience. Furthermore, sometimes prescriptive or detailed regulations can have the effect of having the operator meet the minimum requirements and no more. This may have the undesired effect of limiting efforts toward continuous improvement.

For prevention of systems failure accidents and to maintain adequate levels of safety, purely prescriptive regulations and rules are rarely sufficiently detailed or specific enough to cover the wide array of complex and inter-related systems and situations that can occur. Systems failures are complex and rarely involve the exact same causes, making it difficult to prescribe specific solutions to cover future accidents. On April 20, 2010, prescriptive rules for some critical operations and procedures that contributed to the Deepwater Horizon accident were vague, inadequate or absent²⁰ and safety management systems designed to reduce the risk of failure during these operations were voluntary and ineffective.

Because of the complex and wide-ranging nature of safety management systems and the relative lack of offshore Arctic operational experience, there is a need for greater reliance on goal-setting and performance for regulating operations in the Arctic offshore.

The AOOGG discusses prescriptive and performance-based approaches to regulation²¹ and found that a hybrid system consisting of components of both approaches is likely most appropriate for Arctic offshore operations. The RP3 (Recommended Practices for Arctic Oil Spill Prevention) Report also developed the same conclusion²².

²⁰ (National Academy of Engineering, Macondo Well-Deepwater Horizon Blowout: Lessons for Improving Offshore Drilling Safety, 2011, p. 84)

²¹ (PAME, 2009a, p. 25)

²² (EPPR, 2013a, p. 7).

Challenges

- Prescriptive regulations for operations can limit the approaches and technologies best available to do the work safely in any given situation;
- Prescriptive regulations take time to develop and implement and often lag behind advances in operating technology and practices;
- Relying solely on prescriptive regulations might cause the operator to meet only minimum requirements and not advance the level of safety through continuous improvement initiatives;
- Prescriptive regulations may lead to an “affirmative defense” by the operator or company in the event of an accident, which essentially claims no liability if they followed the rules or the plan was approved— thus placing the responsibility for safety and environmental protection back on the regulator.
- Challenges exist for the regulator in implementing management system frameworks in a performance-based system. These include:
 - Distinctly different set of skills required for regulatory staff in a performance-based vs. prescriptive regime;
 - More time-consuming implementation for regulatory staff;
 - More data and analysis required;
 - More guidance and education required from the regulator.

Recommended Actions/Approaches

- Although prescriptive regulations may be appropriate and effective for some elements of the safety systems, Arctic countries should consider expanding, where appropriate, more performance-based regulatory systems.
- Arctic countries must ensure that regulators are properly trained in techniques and practices of a performance-based regime, and that such a system is adequately funded and staffed.

6.2 Some Regulatory Regimes Around the Arctic

Authorities from Arctic states are engaged in many initiatives and programs to respond to the risks of systems failure accidents in the Arctic offshore (see Appendix E). Arctic states have different systems of regulation that are generally determined by their own operating conditions, national culture and social, political, and economic circumstances.

Using the same nine (9) categories selected for guidance/recommendations, Table A1 in Appendix A summarizes the regulatory regimes governing these elements from Norway, Canada, Greenland and the United States. For more detailed coverage of the regulatory text, the reader should consult the online supporting document Table of Safety Systems Elements in Regulations of Norway, Canada, Greenland and the United States, and of the PAME AOOGG 2009 (www.pame.is).

6.3 Some Common Arctic Standards and Best Practices

Issues and Considerations

There are few standards related to the Arctic specific aspects of offshore operations, although some international and/or industry standards are applicable, at least, in part to operations in the Arctic. Standards can range from specifications for equipment to goal-based guidance and best practices. As most Arctic nations are moving toward performance-based regulatory approaches, some standards will be focused on process (and outcomes) more than on specification/design, such as HSE management systems, competency, performance measures, risk management, etc.

Many existing and newly-developed international standards may be appropriate in the Arctic and thus address to some extent the call for the use of international standards in the Arctic²³.

However, systematic review of globally applicable international standards for suitability in the Arctic has only been done for a few of the available standards such as in the 2010 International Organization for Standardization (ISO) 19906 *Standards for Arctic Offshore Structures*, or the Barents 2020²⁴ project where some 130 offshore standards were adopted or modified for common use in the Barents Sea. Efforts are underway in ISO for developing Arctic offshore oil and gas standards based on the results of the Barents 2020 program (see Appendix E for further ISO Standards initiatives).

Challenges

- No single authoritative entity or organization exists to comprehensively or systematically address Arctic specific standards;
- Due to personnel, financial and time constraints, it is difficult to coordinate standards initiatives across the Arctic among each other and regulators must, therefore, prioritize involvement in cooperative activities with industry;
- Varied operating conditions in different Arctic areas may hinder the application of specific technical standards across the Arctic offshore;
- Different standards are established by the various governments, companies and organizations involved and these may cover similar operations or processes.

Recommended Actions/Approaches

- Industry and the regulators must work together to initiate, implement, monitor, and continuously improve safety management systems and safety culture in Arctic offshore oil and gas operations.
- Regulators should stay actively involved in international initiatives for developing standards for Arctic offshore oil and gas activities.
- Arctic states should promote international standards and promote or establish an Arctic Offshore Regulators Forum to address and share knowledge of offshore Arctic-relevant issues, for example, standardizing and reporting incident and near-miss incidents.

7. Guidance Tools and Approaches for Improving Safety Culture and Safety Management Systems

²³ (Department of Interior (DOI), 2013; National Commission on BP Deepwater Horizon Oil Spill and Offshore Drilling Report to the President PC, 2011; National Energy Board NEB, Arctic Drilling Review, 2011; AOR, PAME, 2013c; and EPPR, 2013a)

²⁴ http://www.dnvusa.com/Binaries/Barents_2020_report_%20phase_3_tcm153-519577.pdf

7.1 Coordination Among Regulators

The overall importance of defining, implementing and continuously improving ‘safety culture’ in relation to Arctic oil and gas activities was underscored in Section 5. Furthermore, the role of regulations and standards was examined in Section 7. Whether seeking to pursue continuous improvement initiatives, better and more focused training or more effective communication, another vital element for regulators to address is coordination.

Facilitate oil spill prevention research and regulatory cooperation:

It is recommended that the Arctic Council establish a mechanism whereby regulators are able to share experiences, practices and compliance and operational information (e.g. near-miss data). RP3 Summary Report Recommendation number 5.

Coordination among regulators is absolutely essential for accident prevention. Sharing experience on mistakes made, hazards encountered, and supervisory mechanisms that work can only serve to refine and improve the tools that regulators must use to constantly raise the bar and improve safety (or minimize risk of failures) in the Arctic oil and gas sector.

Arctic countries should establish a mechanism through which to share experiences, and should coordinate and cooperate concerning their methods of risk and impact assessments and management of the oil and gas industry. From Recommendation 5, OGA Chapter 7, p. 7_15

The need for coordination among regulators was identified in several Deepwater Horizon investigations, Arctic hearings, and in discussions at the workshops. Formalized Arctic regulator coordination in some form has been recommended in the OGA, AOOGG, RP3 and AOR²⁵. Appendix G outlines some existing regulator coordination mechanisms pertinent to Arctic operations. On October 13, 2013, the first meeting of Arctic safety regulators was held in Stavanger, Norway and as of early 2014 discussions are underway to investigate whether and how to make a permanent Arctic Regulators Forum.

The following nine (9) elements are highlighted for more specific guidance in sub-sections 7.3 to 7.11.

- **Continuous Improvement**
- **Risk Assessment/Hazard Identification**
- **Management of Change**
- **Training and Competence for Arctic**
- **Accountability and Responsibility**
- **Operating Procedures**
- **Quality Assurance/Mechanical Integrity**
- **Documentation and Reporting**

These systems all have as a common and central feature a cyclic process involving sequential consideration of:

- policy and strategic objectives;
- organization, resources and documentation;
- risk evaluation and risk management;
- planning;
- implementation and monitoring; and
- auditing and review

(AOOGG, 2009, p.26)

²⁵ Oil and Gas Activities (OGA) in the Arctic: Effects and Potential Effects (2007); Arctic Offshore Oil and Gas Guidelines (AOOGG)-2009; Recommended Practices for Arctic Oil Spill Prevention (RP3), 2013; Arctic Ocean Review, Phase 1 (2011) and Phase II (2013).

- **Communication**

Some issues and challenges faced in addressing each of these safety system elements and suggested actions or approaches are put forward in order to minimize the chances of system failures going forward. But before discussing each of these elements in turn, the sub-section 7.2 examines more closely the role and importance that safety culture plays in providing the overall framework and foundation for safety actions and ongoing vigilance.

7.2 Safety Culture

Issues and Considerations

Investigations of the Deepwater Horizon accident and Montara well blowout all pointed to a lack of positive safety culture as a root cause of the chain of events and flawed decisions that led to the April 2010 disaster in the Gulf of Mexico²⁶. In 2012, over two years after the Deepwater Horizon incident, an assessment of Shell Oil company's 2012 operations in the U.S. Arctic offshore, revealed a lack of positive safety culture²⁷. During an inspection of the drill ship *Noble Discoverer* used by Shell, the U.S. Coast Guard found that preventative maintenance was not performed, audit records were unavailable, crew were not familiar with vessel safety management systems, mandatory crew drills were not conducted, alarms were inoperable, equipment repairs were jury-rigged, and there were safety violations—all indicators of poor safety culture.

While there may be many definitions of “safety culture”, it can generally be described as the attitudes, values and behaviours shared within (and across) a company or organization aimed at minimizing risk and maximizing safety. It is especially important as it provides the overall framework for decisions and actions which ultimately affect the safety record and performance of the enterprise. A fuller outline of some definitions, attributes and ways of measuring `safety culture` is included in Appendix F.

Safety culture touches all management system elements and is integrated into a company's operations from top to bottom, from the CEO to the drilling engineer, to the tool-pusher. A positive safety culture is part of a company's DNA--it is evident at all stages of operations, from planning through decommissioning. With all else being equal (i.e. use of best technology, best practices, attention to standards and applicable regulations, etc.), an organization without a positive safety culture is more likely to experience a systems failure accident. It is clear from case studies of accidents and management systems, that government has a role to play in ensuring that the operations management has (and actively applies) a positive safety culture²⁸.

²⁶ (NAE, 2011; PC, 2011; PAME 2013a, p. 6; and PAME 2013b, p. 5)

²⁷ (DOI, 2013)

²⁸ (PAME, 2013a, p. 14 and PAME, 2013b, pp. 6, 15, 22, and 45)

Safety culture must be defined, understood, and clearly communicated by operators to everyone, including contractors, and to the regulators. This includes a process to put in place a consistent policy for safety culture that²⁹ :

- Says the organization has a safety culture and defines it,
- Has leadership commitment to safety culture and a strategy for creating, instilling, and maintaining a positive safety culture, and
- Has a methodology for assessing the state of safety culture within the organization in order to identify possible `culture` threats to safety and environmental protection.

“A company never “gets” a safety culture. It is a continuous process of improvement and always needs work. It’s not a destination, it’s a journey.” (PAME, 2013b, p. 46)

An important management tool to assist the operator in meeting the regulatory objectives of either system, eliminating unsafe behavior, and achieving continuous improvement in safety and pollution prevention practices is defining and communicating a culture focus on safety and environmental performance to the workforce and ensuring that they are fully motivated to implement it through a management system (AOOGG, 2009 p. 25).

It matters little that an operator has a comprehensive safety management system and a positive safety culture improvement process in place if these are not implemented effectively. At the time of the Deepwater Horizon accident, BP had a world-class safety management system with a process for implementing and improving safety culture. In 2012, Shell also had a strong focus on safety culture in their HSE Management system³⁰. However, it would appear these were not implemented effectively.

Challenges

Some key challenges to fully adopting and delivering an effective safety culture include:

Unacceptable Behaviour accepted as Normal Practice (Normalization of Deviance from Safety Policy and Procedures)

The Deepwater Horizon/Macondo accident has been shown to have occurred due to a series of human errors, organizational failures

and bad judgments that were made without careful consideration of the risk or consequence. For such a sequence of bad judgments and decisions to take place, it is apparent that systems safety was not part of the culture that existed on the Deepwater Horizon leading up to the time of the blowout. Safety systems vigilance and management were deemed to be inadequate and established safety policy and processes were either absent or not adhered to. Unacceptable behaviours had simply become accepted as normal practice.

“SNAFU--Situation Normal All Fouled Up”

²⁹ (PAME, 2013b, p. 53):

³⁰ (PAME, 2013b, p 30)

Complacency

Complacency stemming from looking at the wrong indicators of systems safety is a risk factor for low probability-high consequence accidents.

“Can’t happen here, Can’t happen to me, Can’t happen again”

Occupational safety was being rewarded on the Deepwater Horizon Platform when the blowout occurred. Safe work records and no-loss work days do not necessarily reflect a positive safety culture nor serve as reliable indicators of systems safety. Acceptance and belief in an outstanding occupational safety record or a company’s own public relations statements about safety can offer a false sense of security. This can result in complacency and acceptance of substandard conditions or tolerance of inadequate systems or resources.

Even though there have been no major accidents in the Arctic offshore, there should be no complacency or over-confidence.

“...the receipt of safety awards is a “predictor” of major safety incidents. Winning of safety awards should be the biggest warning sign to a company that complacency may be an issue.” (PAME, 2013b, p.45)

There has simply been less activity in this frontier area and fewer wells drilled. Furthermore, with extended periods between activities, many of the benefits of institutional knowledge and experienced personnel have also been lost over time.

Tolerance of Inadequate Systems or Resources

Many early onshore Arctic oil exploration accidents and environmental damage occurred as a result of simply importing southern techniques and technologies to the north which failed to be effective³¹. But with the prevalent “can do” attitude, lessons were learned and the technologies and practices were modified to correct inadequacies or mistakes made. Arctic offshore oil and gas operations experienced this frontier “can do” attitude and culture first in the late 1970’s and mid-1980’s when Arctic offshore exploration was at its peak (Figure 1). The fact that there were no major Arctic offshore incidents during this “frontier” period should not give rise to a sense of over-confidence.



There is no room for makeshift, adapt-on-the-fly, practices for maintenance and repair used in the past. “Can do” attitudes should not be accepted; instead “Can do safely, or won’t do” should prevail.

³¹ Arctic Oil and Gas 2007, Arctic Monitoring and Assessment Program, 2007, pages 22-23. www.amap.no/oga

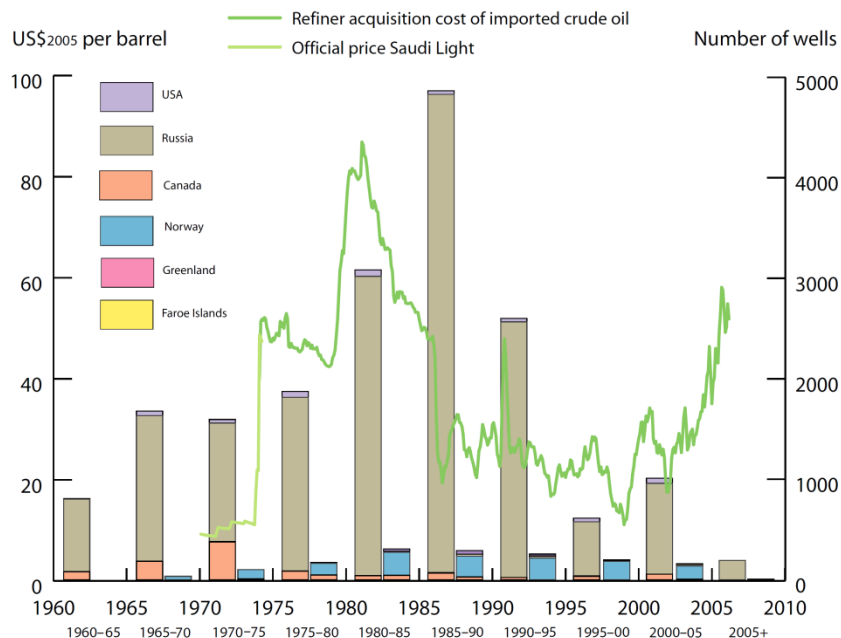


Figure 1. Number of exploration and discovery wells from 1960 to 2007 in 5-year increments. Paired columns show onshore wells on left and offshore wells on right. plotted against the oil price curve, adjusted for inflation to 2005 dollars, from the Energy Information Agency, 2007. Modified from OGA Chapter 2 Figure 2.2c (OGA, 2010).

Work Pressure

Time and personnel constraints, along with the higher costs associated with frontier oil and gas activities, all can act to increase work pressure, which, in turn, makes an accident more likely to occur. Operations like the Macondo deepwater well in the Gulf of Mexico are very expensive endeavors. Any schedule delay is measured in millions of dollars a day. This cost-awareness placed pressure on the management and drilling team of the Deepwater Horizon and affected decisions that led to the disaster. Arctic drilling operations are also complex and expensive—up to \$60 million per exploration well³², even in shallow water and total costs can be in the billions of U.S. dollars.³³ These costs are not unknown to those involved in planning, fabricating and working to complete the program.] Pressure to complete the work could be easily heightened by a shorter drilling season and harsher operating environment compared to other offshore areas. “Can Do” attitudes from the past must be replaced with more risk averse approaches where systems safety performance is clearly paramount.

“Time is money!”

Recommended Actions/Approaches

- Regulators must define and communicate expectations regarding positive safety culture and require operators to establish (and implement) their safety culture;

³² AMAP, 2010 p.2_12

³³ Alaska Journal of Commerce: Shell Seeks Positives as Tab Nears 6 Billion, by Tim Bradner, Published, 2014.02.06

- Encourage (or require) regulated companies to create a shared understanding (within and across partners/contractors) of exactly what constitutes positive safety culture in Arctic offshore activities;
- Require operators to define how they will instill and deliver the positive safety culture in its workforce and verify implementation through reviewing a combination of leading and lagging performance indicators, backed up by frequent field inspections by the regulator;
- Require operator to designate a responsible and accountable person (preferably the CEO) for their safety culture;
- Define and communicate indicators of a poor or degrading culture as a threat to safety and require operators to establish (and monitor) indicators of positive safety culture;
- Regulators should share indicators of safety culture through some inter-governmental/industry forum;
- Require operators to have a verifiable process to improve safety culture through constant monitoring and assessment and the use of leading indicators, such as described in the Safety Culture workshop (PAME, 2013b, p. 47 – see also Appendix F to this report).
- Conduct audits on a risk-based prioritization schedule and use the results to address improvement opportunities in the safety management system and safety culture;
- Consider providing financial incentives (for good behavior) and disincentives (for bad behavior):
 - View the safety and environmental record of the whole company as an indicator of performance;
 - Tie safety and environmental performance to lease or license qualifications;
 - Enact `whistle-blower` provisions and personnel protection guarantees;
- Operators and regulators should always experience “Chronic Unease” to avoid complacency.

7.3 Continuous Improvement

Issues and Considerations

To prevent a major accident from occurring during offshore oil and gas operations in the Arctic, industry must implement, monitor, and continuously improve their safety management systems. In the Arctic offshore, it is imperative that performance is improved on an ongoing basis by systematically monitoring, assessing, and managing risk in these complex frontier operations.

The following are good examples of leading indicators and can be critical to ensuring continuous improvement within the system:

- Inspections;

- Measurement and Monitoring;
- Corrective and Preventive Actions;
- Records Management;
- Change management;
- Internal Audits and Management Reviews, and
- Implementation of follow-up measures.

For industry, continuous improvement in their safety management systems should be integrated throughout the whole life-cycle process--from design to decommissioning and include:

- Risk assessments and analysis;
- Audits, inspection reports and critical system reviews; and
- Ongoing monitoring and follow-up actions.

The process of continuous improvement is driven by data and information and the analysis of performance trends from that data. It is imperative that all safety and pollution incidents and near-misses be reported, analyzed, and the analyses shared throughout the industry in order to identify trends in safety performance and safety culture that indicate potential for a systems failure accident. It is also important that this trend information be made public. Sharing of data and transparency in public disclosure of these analyses is important not only to build public trust but also to assist in hazard identification and facilitate emergency response.

Challenges

- Cooperation between Regulator and Operator can sometimes be elusive or strained;
- Data are not always available or collected routinely;
- Data are not analyzed for identifying opportunities for improvement;
- Data collected may vary considerably and lack of industry standards may result in an inability to benchmark or compare performance.
- Operator may not have an effective system to improve performance based on their performance assessments;
- Operator may not always implement their safety management systems effectively.

Recommended Actions/Approaches

- Regulators must continuously improve supervision by reviewing the regulatory system for clarity and effectiveness. They must also regularly evaluate and seek to improve the effectiveness of their influence;
- Ensure continuous improvement is accomplished through:
 - Periodic regulatory reviews and follow-up changes or clarifications;
 - The application of risk-based regulation, focusing on critical operations, known hazards, and results of safety performance evaluations of the operator;
 - Application of safety management system principles throughout the life-cycle of operation from leasing/licensing to monitoring and ultimately decommissioning;
 - Monitoring environmental and safety performance;

- Conducting audits that examine company safety meeting records, maintenance logs, operator follow-up to known deficiencies, results of company internal audits, employee questionnaires, etc.;
 - Open and frequent communication with the operator about how to improve their performance when deficiencies are identified;
 - Both regular (and random) inspections;
 - Meaningful enforcement actions.
- Continuous improvement in offshore performance should be seen as a collaborative activity requiring cooperation and actions by both industry and regulators.

7.4 Risk Assessment/Hazard Identification

Issues and Considerations

The U.S. National Investigation of the BP Deepwater Horizon Oil Spill³⁴ found that a survey of the Transocean crew regarding “safety management and safety culture” was conducted on the Deepwater Horizon just a few weeks before the accident. The results

of that survey found that Transocean’s front-line crews were “*potentially working with a mindset that they believe they are fully aware of all the hazards when it’s highly likely that they are not.*” Risks and hazards must be communicated clearly and understood by all who may affect, or be affected by, them. This is central to an effective safety management system. It is done through a formal process established by the operator and implemented throughout the whole company and may include training, communication, clearly designated responsibilities and the unwavering pursuit of a positive safety culture.

All parties should continuously strive to improve health, safety and environment by identifying the processes, activities and products that need improvement, and implement necessary improvement measures. The process of identifying what can be improved may be based on mappings and results of analyses, investigation of situations of hazard and accident, or near hazards and accidents, handling of non-conformities, experience from internal follow-up or auditing, or experience gained by others (AOOGG, p. 6)

What is different about operations in the Arctic and what increase in risk is associated with those differences? $\Delta \text{Arctic} = \uparrow \text{Risk}$

Risk of system integrity issues leading to accidental release (pipelines and drilling installations) as a result of:

- \uparrow **Probability**
- \uparrow **Risk**

\uparrow **Probability**

- environmental effects on personnel
- communication challenges
- timing/seasonal pressures
- ice and icing + temperatures result in unique design considerations
 - equipment and instrumentation
 - scouring
 - permafrost trapping gas
 - leak detection
 - burying of pipelines
 - cementing

\uparrow **Consequence**

- efficacy of response
- environmental consequences/sensitivities
- lack of infrastructure
- economic effects of limiting future activities
- social acceptability of impacts on previously undeveloped areas

(PAME, 2013a, p. 42)

³⁴ PC, 2011 – National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling Report to the President;

In the Arctic, there are many hazards to human health, safety, and operational integrity not encountered elsewhere. Hazards encountered are often amplified and must be accounted for in any risk assessment or hazard identification. These may include extreme cold, moving ice, icing, darkness, dense fog, strong winds, strong currents, dangerous sea states, remoteness, offshore permafrost, ice scouring, subsea methane hydrates, and environmental sensitivities. Valuable information for the operator in assessing risk should include local and Traditional Knowledge (TK) on weather, sea ice for operating considerations such as marine transportation, ice roads, and environmental and cultural sensitivities.

A relatively common and non-threatening hazard found elsewhere, such as shallow gas or active faults, may pose a much greater risk in the more extreme conditions encountered in the Arctic.

Reporting of “near-miss” data becomes particularly important given the lack of experience and history of operations in the offshore Arctic. It is important for ongoing hazard identification and risk assessment to have all incidents and near-misses reported. Such analysis can help others better understand the risks or potential incidents and continuously improve safeguards in their operations.

Risk management is an integral part of an operator’s safety management system. In addition to the Environmental Risk Flow Diagram example contained in the AOOGG 2009 (p. 88 Annex F) for evaluating risk, other risk diagrams such as so-called ‘Bow-Tie Risk’ diagrams (Figure 2 below) can be helpful. These serve to illustrate multiple pathways for possible failure and associated barriers and can improve barrier management and risk monitoring.

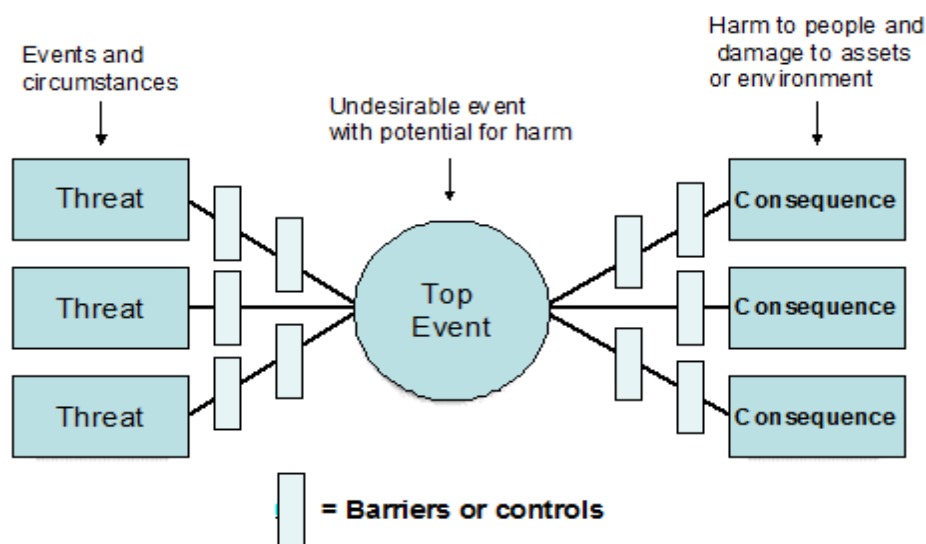


Figure 2. Example of a Bow-Tie Risk Diagram

Use of ‘Failure Modes & Effects Analysis’ allows the assessment of the ability to monitor and to check risk levels and margins. This can be factored into a Bow-Tie analysis, where risk levels and margins become much more evident and help to better expose the overall risk.

Challenges

- Risk analysis for low-probability, high-consequence events is complicated due to the lack of adequate statistical data;
- The complex structure of the offshore oil and gas industry and the variety of technical expertise can adversely affect the ability to perform and maintain margins of safety;
- Different methodologies used by regulators and industry present challenges to establishing and comparing risk assessment and hazard analyses;
- Detecting and mitigating change in risk can sometimes be elusive;
- Uneven levels of uncertainty, complexity, hazards, consequences, and overall risk in Arctic conditions can frustrate analyses.
- Incremental addition of risk resulting from decisions and actions taken across units, departments, and contractors that individually fall within the prescribed safety envelope can cumulatively raise the level of total risk for the operation beyond acceptable limits.
- Possible difficulty convincing shareholders to spend the money necessary to prevent a `once-in-a-career` disaster.

Recommended Actions/Approaches

- Require operators to assess risk in offshore Arctic areas on an ongoing basis. Factors include:
 - Geology in the well including shallow gas, permafrost and methane hydrates;
 - Weather, sea, ice;
 - Improvement in the management of change.
- Require the operator to regularly assess risk relevant to operating in Arctic conditions in order to inform the process of improving regulation and standards development as well as operator and industry guidance;
- Require the operator to assess risks associated with cold environment technological solutions to improve process safety performance before a breakdown or accident happens.
- Consider the use of a risk-based approach to regulation of Arctic operations such as Continuous Improvement Cycle or Risk-Based Life Cycle (RBLC) approach that prioritizes regulatory supervision according to risk. This should be carried through the full operation and life cycle of activities and should link the degree of regulatory supervision to critical operations and to a company's performance history.

A risk analysis should:

- address prevention of injuries, loss of human life, and pollution of the environment;
- include risk criteria that have been defined prior to conducting the analysis and document the evaluations forming the basis of the acceptance criteria;
- be used to follow the progress of activities in planning and implementation;
- identify risk that has been assessed with reference to the acceptance criteria, form the basis of systematic selection of technical operational and organizational risk to be implemented;
- be updated on a continuous basis and included as part of the decision-making process; and
- systematically follow up implemented risk reducing measures and assumptions made in the analysis to ensure safety within the defined criteria (AOOGG, p. 36).

- Employ Risk Management/Operational Controls by:
 - requiring monitoring of risk and risk margins especially those worsened by Arctic conditions (e.g. permafrost, ice and icing, cold, remoteness from infrastructure, etc.);
 - requiring improvement of barrier management;
 - requiring improvement in situational awareness (e.g. weather, ice, sea conditions);
 - requiring additional direct monitoring and control instrumentation to replace indirect measures;
 - requiring real-time operations centers for all wells being drilled in the offshore Arctic;
 - having government regulators involved in real-time monitoring at critical points in the operations—such as negative pressure tests and during other critical procedures. Ensure the regulator is knowledgeable and trained in the operations being monitored.
 - considering the use of the multi-lingual ISO 31,000 High Level Risk Management Guidelines for common terminology and communications;
 - requiring integrated risk assessment and analysis for the whole spectrum of the operation.
- Safety Margin Management should be used as a proactive approach to ensure margins of safety are established in the design phase. Have the operator:
 - define the safety envelope;
 - clearly establish proven practice;
 - assess uncertainties and adjust levels of safety margins;
 - factor in the differences in exploration and production operations and geology and Arctic ice type/conditions.

7.5 Management of Change

Issues and Considerations

Management of change is vitally important in complex and varying offshore operations. Management and the crew aboard the Deepwater Horizon were found to have neither adequate training nor sufficient understanding of the consequences of operational changes. They

essentially failed to appreciate or plan for the safety challenges posed by the Macondo well.³⁵ Planning and training for changes in Arctic operations can be especially critical in circumstances where environmental conditions are dynamic and restrictive, communications may be difficult, and personnel may be working under the pressure of a relatively short drilling season. Limited availability and experience of some personnel and equipment can add to this challenge. Greater flexibility is therefore needed to manage the changes to plans and procedures associated with personnel and equipment operating in this challenging environment. Robust risk assessments, thorough training and effective communications can all act to lessen the challenge (and fear) of managing change.

Challenges

- Developing appropriate risk analysis processes and tools for handling of changes to the drilling plan during the operational phase;
- Managing complex operations that change due to extreme or dynamic Arctic environmental conditions;
- Improving safety management systems which might include poor training, poor risk assessment, deficient documentation and inadequate communications;
- Augmenting awareness of exactly what constitutes ‘change’;
- Ensuring resiliency/flexibility is built into the safety management systems;
- Reversing the poor safety culture that may exist.

“The ability of the oil and gas industry to perform and maintain an integrated assessment of the margins of safety for a complex well like Macondo is impacted by the complex structure of the offshore oil and gas industry and the divisions of technical expertise among the many contractors engaged in the drilling effort.” (NAE, 2011, p. 4)

Recommended Actions/Approaches

- Regulators and operators must constantly seek to improve their approach to the Management of Change -- through hazard identification, risk analysis/assessment, and management processes and tools aimed at better handling of any changes to the drilling plan during the operational phase.
- Regulators should require the operator to undertake a rigorous assessment of risks (using a risk assessment matrix or other suitable methodology) for each critical procedure or operation in the Arctic offshore. Among other factors, these assessments should take into account the full range of relevant Arctic multipliers.

7.6 Training and Competence for the Arctic

Issues and Considerations

Insufficient training and lack of training were identified as contributing factors in the Deepwater Horizon accident³⁶ and have been found to be a common factor in many major industrial

³⁵ PAME Report – Findings and Recommendations of the Health, Safety and Environmental Management Systems Workshop – 2013a, pg 6;

³⁶ National Academy of Engineering (NAE) – Macondo Well-Deepwater Horizon Blowout: Lessons for Improving Drilling Safety Offshore – Observation 6.2 – NAE 2011;

accidents.³⁷ Specialized mechanical and human factor training for cold weather operations, firefighting, emergency and environmental response and cultural sensitivity will be required of personnel working in the Arctic. Cross-training will also be necessary for personnel who may be required to fill-in for (or assist) primary personnel in critical operations due to either limited vessel occupancy capacity or in case of emergency response.

In Arctic operations, it is particularly important to have a well-trained, competent and self-reliant crew in the face of possible longer crew rotations and sometimes unpredictable ‘shore-to-rig’ transport due to ice or extreme cold conditions.

For the regulators, a performance-based regulatory regime involves a wider scope of supervision, a broader perspective (i.e., integrated oversight vs. compartmentalized review), requiring personnel with more and different skills than a typical prescriptive regime. It can be compared to going from being a cop-on-the-beat to a major-crimes detective. Both are police, but have far different skill sets. Instead of inspecting facilities and equipment, checking boxes on compliance forms, and issuing notices and citations, the process for monitoring, improving and enforcing safety and environmental protection in a performance-based regime, requires more people, training and support.

Challenges

- Qualified and Arctic-experienced personnel may be difficult to recruit;
- It may be difficult to find and hire personnel experienced and capable in more than one subject area and who are expected to perform well often under extreme and isolated conditions with limited supervision, communications and transport capability;
- Difficulty engaging regulators with the training and experience needed to effectively handle a wide scope of issues and circumstances;
- Recruiting and maintaining a trained and competent regulatory workforce is difficult.

Recommended Actions/Approaches

- Require operators to demonstrate that all personnel (including all contractors and subcontractors) have the required and appropriate training and competency for operations in Arctic waters;
- Competency requirements for regulatory staff should include both technical and non-technical skills and knowledge. These should include those related to disciplines such as human factors, management systems, system safety, and safety culture;
- Regulators should ensure and verify that operators conduct both scheduled and unscheduled safety drills.

7.7 Accountability and Responsibility

Issues and Considerations

³⁷ PAME Report – Findings and Recommendations of the Health, Safety and Environmental Management Systems Workshop – 2013a, pg 15;

In Arctic offshore operations it is critically important to have accountability and responsibility clearly established and understood by the operator, contractors and regulators. The operator has to be responsible for safety and environmental protection including matters such as well design and operation, barrier management, and well monitoring. In complex Arctic offshore operations, the operator is the only one with the knowledge and understanding of the whole operation and overall risks involved. They must have access to all of the information and data needed to make critical decisions about maintaining margins of safety. The operating company clearly has to have the overall responsibility for integrating all aspects of the safety system.

The operator is also responsible for establishing, implementing, monitoring and improving their safety culture and their safety management systems. Having personal accountability and refining that accountability through incentive programs and other methods can be very important to motivating the operator's behavior.

The operator is also responsible for their contractors and subcontractors and for establishing clear lines of responsibility and accountability. Bridging Agreements or similar documents can help lay out the expectations and obligations between contractors and the operator.

The regulator is responsible for examining and authorizing (or rejecting) the design and operation of safety management systems as well as tracking existing and emerging risks in the industry.

Accountability has to go through everyone in the operators' organization who has potential to impact safety—from the drilling engineer to the tool pusher, to the mechanic, and all contractors. ***Everyone has personal accountability for safety***, which is fostered by a positive safety culture clearly articulated (and committed to) by the highest levels of management and embraced throughout the organization.

Challenges

- Standard communication processes do not necessarily translate to the Arctic. Lines of authority can sometimes be blurred or unclear between the field and the head office and even between the drill floor and the control room.
- Shifting the focus of the regulator from prescribing operational specifics to assessing, verifying, improving and enforcing the operators' management system and safety performance levels.
- Preventing corporations from sometimes undermining positive safety culture, e.g. by:
 - Using volunteers to get around refusal to do unsafe work;
 - Granting status and compensation to those who do unsafe work;
 - Skewing authority and accountability toward simply getting the job done.
- Maintaining strong, direct management and oversight and dealing clearly and effectively with layers of contractors, subcontractors and sub-subcontractors in the Arctic petroleum industry;
- Addressing the many and varied cultural attitudes and responses to high-hazard operations.

Recommended Actions/Approaches

- Regulators should hold the operator accountable for developing a comprehensive Safety Management System and a robust and identifiable safety culture.
- Regulators should observe and validate the operator's safety management system and safety culture and gauge opportunities for improvement.
- Regulators should hold the operator responsible for contractor safety training, competence and certification and have the operator demonstrate an effective process for managing them.
- Regulators should require the operator to designate who is responsible at all times for critical decision-making processes and ensure those designated sign all associated safety management systems and safety culture documents.
- Regulators should regularly track existing and emerging risks in the industry.
- Arctic countries should train government auditors to ensure competency and confirm adequate and appropriate supervision is undertaken.
- Field inspection programs are very expensive to implement. The regulator must be prepared to support a robust inspection program.

7.8 Operating Procedures

Issues and Considerations

Operating procedures are an important element of systems

safety. As shown in investigations of the Deepwater Horizon accident, sometimes an operator's own best practices and procedures are not always followed³⁸ because of poor safety culture, inadequate training or work pressure.

Of primary importance is the need to ensure that wells remain under control at all times during drilling, well-completion, production, and well-workover operations. This capability must be maintained even while operating under extreme conditions. (AOOGG, 2009, p 36)

These factors must be carefully assessed industry-wide and processes should be put in place for taking into account that standard operating practices and work processes used in other subarctic areas may not be transferable to all Arctic regions. Procedures used in areas outside of the Arctic, or in one part of the Arctic, may not be applicable or effective for use in other Arctic areas. How the Arctic environment can affect human factors, materials, equipment and procedures must be clearly understood. Operating procedures and work processes can impact safety and environmental protection and require carefully thought-out modifications and adjustment. Improper operating practices have been a key factor in many offshore accidents and warrants great attention by regulators and industry in the Arctic. Furthermore, operational control procedures for dealing with both normal and abnormal Arctic conditions must be clearly defined and included in the operator's safety management system. Consultation with local and indigenous communities with respect to weather, sea state, ice, temperature and sensitive ecological conditions can also provide a valuable additional source of information for assessing overall safety and environmental risk.

³⁸ (PC, 2011, Chapter 4)

There are efforts underway to standardize some of these operating practices, most notably through the International Organization for Standardization (ISO)³⁹ (see Section 7.3 and Appendix E). The United States is proposing new standards for their Arctic operations⁴⁰ (See Appendix E). The Arctic Council has recently established a Task Force on Arctic Marine Oil Pollution Prevention that will develop an Action Plan, and related cooperative arrangements by 2015, that may include pursuing agreed best practices.

Challenges

- Limited experience related to Arctic-specific features compared to other offshore petroleum operating regions;
- Use of subarctic operating practices may be inappropriate, ineffective, or need modification in some parts of the Arctic;
- Higher operating costs;
- Lack of adequate preparation can put pressure on operations and schedules at the end of the operating season;
- Operating procedures at different locations can, to varying degrees, be affected by darkness, extreme cold, ice, extreme weather, structure icing, environmental sensitivity, remoteness, and a relatively short exploratory drilling season. This can place extra work pressure on operators to get the job done;
- Operating procedures used in the Arctic must often be adjusted to respond to the diverse conditions in different regions and seasons;
- Operational procedures may need to be modified for drilling and non-drilling activities and from periods of mobilization to demobilization.

Recommended Actions/Approaches

- Regulators must ensure that the operator's proposed procedures are included in integrated plans and safety scenarios. The regulator must review these to assess whether they are appropriate for the region, season and activity, and are adequate for the proposed operations.
- Regulators should pay careful attention to any proposed modifications by the operator to account for Arctic conditions or changes expected during Arctic operations. Regulators should also ensure that the risks of these changes are properly considered, analyzed and mitigations are identified by the operator.
- The regulator should monitor all critical operations, through onsite inspection, daily reports, and through real-time-operations centers, to ensure procedures are safe, protect the marine environment, conform to the safety management plan, and meet regulatory requirements.

³⁹ Barents 2020, ISO Standards for offshore structures, and new TC67 initiatives for Arctic operations.

⁴⁰ US Senate Testimony of BOEM Director

http://www.boem.gov/uploadedFiles/BOEM/About_BOEM/BOEM_Regions/Alaska_Region/Community_Liaison/Hearings/June%202013%20Public%20Listening%20Sessions%20in%20Alaska.pdf

- The regulator should assess the overall effectiveness of the operator's safety procedures through regular inspections, monitoring, and the review of accident/near-miss and incident reports in order to identify both non-compliance and opportunities for improvement.
- Regulators should have technical training on safety procedures and practices and be given full access to all safety and environmental performance data.

7.9 Quality Assurance/Mechanical Integrity

Issues and Considerations

Attention must be given to the reality that equipment and facilities typically used in Arctic offshore operations must be able to withstand the extra stress and may be more prone to failure from harsh environmental conditions.

Quality control of processes and equipment can play a crucial role in assuring safety of offshore oil and gas operations. For example, a poor cementing job and too few and improper centralizers for the casing were key deficiencies observed in the Deepwater Horizon/Macondo well disaster⁴¹. The assessment of Shell Oil Company's 2012 operations in Arctic Alaska found that contaminated fuel on the towing vessel and the failure of a shackle of questionable origin⁴² on the tow rigging may have contributed to the grounding of the *Kulluk* drilling unit while being towed from Alaska to Seattle, Washington.

Challenges

- Equipment and facilities may require especially scarce or difficult to replace components.
- Depending on location, exploratory drilling season may last only 2-3 months and place extra pressure to perform makeshift repairs or delay maintenance in order to meet operational schedules.
- Maintenance management can be particularly challenging due to remoteness and difficult working conditions adversely affecting ready access to equipment.

Recommended Actions/Approaches

- Regulators should conduct regular inspections and audits of equipment and maintenance records, and meeting minutes, etc. in order to verify that critical equipment is being monitored and maintained and ensure that all components are certified by the manufacturer and properly used by the operator.
- Foreign flagged vessels should receive careful supervision-- cursory inspections are not sufficient to demonstrate the vessel is capable of operating safely in the Arctic.

7.10 Documentation and Reporting

Issues and Considerations

⁴¹ PC, 2011 pp 96-97

⁴² Alaska Journal of Commerce May, 28, 2013 Coast Guard Drills Down on Failed Shackle at Kulluk Hearing http://dec.alaska.gov/spar/perp/response/sum_fy13/121227201/121227201_sr_01.pdf

Interventions for improvements in many of the safety systems such as risk management, quality assurance, maintenance tracking, and adjusting operating procedures, all require monitoring using quality, reliable documentation and reporting. Continuous improvement in virtually all aspects of safety management systems and safety culture requires the collection and analysis of data from reviews, audits, inspections, surveys and reports. Without these solid records documented, it is often difficult to expose deficiencies or track any evidence of deterioration in safety vigilance. The Deepwater Horizon accident investigations found that records of changes to the Blowout Preventer were not documented, which delayed effective control of the blowout.⁴³ In 2012, the United States Coast Guard (USCG) found that the crew of the drill ship *Noble Discoverer*, which had drilled a well for Shell in the Chukchi Sea earlier that year, did not perform preventive maintenance and audit records were not available⁴⁴.

Challenges

- Timely documentation may be compromised by relatively short exploratory Arctic drilling seasons as compared to other regions.
- Documentation, reporting and approvals may be more difficult for some Arctic operations due to inadequate or interrupted communications with the headquarters office and with the regulators.
- Operational changes due to sudden harsh environmental conditions or unexpected equipment issues may be hampered by working and/or environmental conditions or go undocumented due to pressures to stay on schedule.

Recommended Actions/Approaches

- All data should be recorded and submitted or shared regularly within the company and with the authorities.
- Operators should be encouraged to make public their safety plans, contingency plans, emergency response plans, and environmental protection plans.
- In addition to regular operational reports, regulators should require reports on internal audits, near-miss incidents and other safety or environmental non-compliance.
- Data, methodologies, analyses, and trends should be shared between operators and regulators and, where appropriate, such as non-attributable reporting and trend analyses, be made publically available.

⁴³ (PC, 2011, p 138).

⁴⁴ Markey Releases Massive Safety Violations for Shell's Arctic Drilling Ship, Showing Company May Have Sent Unsafe Ship to Drill, Press Release Natural Resources Committee Democrats, Feb 22, 2013
http://democrats.naturalresources.house.gov/sites/democrats.naturalresources.house.gov/files/documents/2013-02-22_Shell_DiscovererShip_Violations_0.pdf

The reports from compliance monitoring activities should include the following information:

- (a) legal basis for carrying out compliance monitoring;
- (b) background for carrying out the specific monitoring activity;
- (c) issues covered during the inspections or audits;
- (d) non-compliances or deviations found, as well as other observations;
- (e) requirements regarding correcting non-compliances or deviations, including time lines and needs for reporting back to the authorities; and
- (f) listing parties taking part in the inspections or audits.

The reports should be available to the public. (AOOGG, p. 29)

7.11 Communication

Issues and Considerations

Communications between head office and the drilling unit/production platform should have back-up systems or contingencies in the event of delays or interruptions. Personal communications and information sharing onboard the rig or platform may be affected by cold and extreme weather. This can affect the regular reporting from the operator on hazards and on the performance of the management system. In an emergency situation, or during a critical management system change, this interruption or breakdown in communications can contribute to failure of one or more elements of the safety management system and may lead to an incident or accident.

Challenges

- Communications on the drilling rig or production platform may be difficult due to a lack of support infrastructure and decreased satellite coverage at high latitudes;
- Delays or interruptions in communications due to extreme cold or extreme weather conditions;
- In a relatively short exploratory drilling season, pressures for completion of the program may defer or reduce important communications between the different operations groups.

Recommended Actions/Approaches

- Regulators should review communications plans, methods and facilities thoroughly and ensure that the operator has adequate and redundant communications capability effective in the area of operation.
- Regulators should ensure that the safety management system establishes and implements clear lines of communication between all players including shore-based personnel, contractors and regulators. Any deviations in communication protocols (or “short-cuts”) proposed during emergencies or interruption periods should be recorded and understood.

8. Conclusions

The foregoing ‘guide’ was prepared to respond to changes that have been observed in the industry, regulatory regimes and in the public’s perception of offshore oil and gas activities since the 2009 update of the Arctic Offshore Oil and Gas Guidelines (AOOGG). It has also had the benefit of numerous relevant accident investigations, notably the Macondo Well/Deepwater

Horizon blowout in the Gulf of Mexico in 2010, as well as two workshops convened specifically to address issues and opportunities for improving safety management systems and the safety culture of operators who operate, or may operate, in the Arctic offshore.

It should be clear from the foregoing that operating in the Arctic is complex, variable and challenging. Regulatory systems and procedures need to take into account the ever-changing nature of the environment, the skills and information available, and the safety management systems and attitudes in place.

It has also been recognized that reliance on a “prescriptive” regulatory regime does not work as well in the Arctic for a variety of reasons (e.g. places responsibility on the regulator, little flexibility, extremely variable conditions, lack of history/data to apply rigorous requirements, etc.). This heavier reliance on performance-based approaches aimed at continuous improvement also means there is a much greater need for mutual understanding and collaborative actions between regulators and operators to get the safety outcomes desired.

It is hoped that this guide can serve to build that understanding and more clearly identify not only the respective roles of operator and regulator in this ‘partnership’ but the actions that each must take in order to make significant and durable improvements in safety management systems and safety culture in the Arctic offshore oil and gas industry. While the guide focuses on the nine (9) safety system elements outlined in Section 7 as priorities for recommended actions, the reader is strongly encouraged to consult and embrace the broader range of guidance and recommendations contained in many of the other documents referenced in the report and contained in the Appendices and online supporting documents (www.pame.is).

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Appendix A

Summary Table of Selected Safety Management Systems Requirements for Norway, Canada, Greenland and the United States

<i>Safety Element</i>	<i>Norway</i>	<i>Canada</i>	<i>Greenland</i>	<i>United States</i>
<i>Continuous Improvement</i>	-requires the responsible party to ensure the management of (and continuously improve) health, safety and environment activities and processes;	-requires management system to include processes for conducting periodic reviews or audits of the system and for taking corrective actions;	-operator required to have policy and commitment to continuous safety and health;	-requires management to be responsible for continued improvement, utilizing personnel with expertise, implementing hazard-related recommendations, and perform periodic evaluations;
<i>Risk/Hazards Analysis</i>	<i>Risk Management</i> – responsible party required to reduce the probability of harm; personnel must be aware of what barriers have been established and which are not functioning; responsible party required to remedy or compensate; -recognized models/methods must be used and maintained; detailed guidance is provided on what is included in risk analyses;	<i>Risk Management</i> - management system must include processes for identifying hazards and for evaluating and managing the associated risks; calls for safety plans and environmental protection plans that set out procedures, resources and monitoring;	<i>Risk Management</i> - the licensee must ensure that environmental risks are identified, assessed and reduced as much as practically possible using best available techniques; -provisions also apply to contractors and subcontractors and others performing the work	<i>Risk Management</i> - all personnel aboard a facility must comply with the policies and procedures identified; - must ensure the development and implementation of a hazards analysis and job safety analysis for all facilities; - must develop and implement written operating procedures; - must document and maintain current analyses for each operation; - must develop and implement safe and environmentally sound work practices for identified hazards; -contractors must be informed of any hazards identified at the facility; - must ensure facilities are designed, constructed and operated according to industry codes and standards;

<i>Safety Element</i>	<i>Norway</i>	<i>Canada</i>	<i>Greenland</i>	<i>United States</i>
<i>Management of Change</i>	NA	-Where equipment, installations, operating procedures or any personnel specified in the declaration changes and no longer conforms, NEB must be notified through a new declaration;	-changes with respect to safety and other substantial changes require the prior consent of the Mineral License and Safety Authority (MLSA) ...and must not take place without such consent;	-requires written management of change procedures to be developed and implemented regarding equipment, operating procedures and conditions, personnel (including contractors) and materials; -requires personnel to be informed and trained prior to any changes; -simple replacement or substitution of comparable performing components are exempted from change procedures; - must document and date all management of change provisions and retain for 2 years;
<i>Training and Competence for the Arctic</i>	-responsible party must ensure sufficient manning and competence in all phases of activitiesand must ensure personnel are not assigned to incompatible tasks; -any changes must be reviewed with respect to impacts on health, safety and the environment;	-management system must include processes for ensuring personnel are trained and competent to perform their duties; -operator must ensure sufficient number of trained and competent individuals are available to complete work safely and without pollution;	-management system must include management of training and competence; -must be a health and safety statement for mobile offshore units and must include max/min manning requirements for operation and orderly evacuation; -operator must ensure staff is adequately trained to perform the tasks according to emergency plan; -employer must ensure staff posses the competence and are adequately supervised for working in offshore installations;	-must utilize personnel with expertise in identifying hazards, environmental impacts, developing safe work practices, etc. -must ensure suitably trained and qualified personnel employed to carry out Safety and Environmental Management System (SEMS); -individuals conducting hazard analysis must be experienced in analysis methods being used; - must ensure all personnel are trained to work safely and are aware of environmental considerations offshore; -specifies initial training, periodic re-training and communication

<i>Safety Element</i>	<i>Norway</i>	<i>Canada</i>	<i>Greenland</i>	<i>United States</i>
			-persons under 18 yrs cannot work on mobile offshore units;	requirements for personnel and contractors; -must document that all contractors are knowledgeable and experienced to perform their duties;
<i>Accountability and Responsibility</i>	-provisions regarding accountability for contractors and all parties -provisions for identifying persons responsible for system establishment, maintenance and implementation	-management system to include arrangements for coordinating the management and operations among owner, contractors and others as applicable; -must identify the name/position of person responsible accountable for establishing and maintaining system and person responsible for implementing;	- operating company responsible for the mobile offshore units must designate an FA Chief who has the top safety and health responsibilities of the offshore installation; -provisions requiring labour leaders and employees to contribute and participate in health and safety program;	-operator, through its management, is responsible for the development, support, continued improvement, and overall success of SEMS program; -must appoint management representatives who are responsible for establishing, implementing and maintaining an effective SEMS program; - must designate specific management representatives who are responsible for reporting to management on the performance of the SEMS program; -in any plan for addressing deficiencies identified in an audit, the person (and job title) responsible for correcting deficiencies must be identified;
<i>Operating Procedures/Work Processes</i>	- responsible party must ensure work processes and resulting products fulfil the requirements related to health, safety and the environment; -work processes must be described with a level of detail commensurate with the importance of the process for	-application for authorization must include description of scope of proposed activities, execution plan, safety plan, environmental protection plan, contingency plans, and a description of decommissioning, abandonment and restoration methods;	-regulations (Section 5) contain extensive requirements with respect to drilling operations to prevent explosions, blowouts, pollution or other damage; -	- must ensure facilities are designed, constructed and operated in a manner compatible with applicable industry codes and standards; -operator required to develop and implement written operating procedures and identify persons (and job titles) responsible for each operating area;

<i>Safety Element</i>	<i>Norway</i>	<i>Canada</i>	<i>Greenland</i>	<i>United States</i>
	health, safety and environment;	-procedures and scope of safety plans and environmental protection plans are detailed out; - operator required to ensure adequate equipment, procedures and personnel are in place to deal with both normal and abnormal pressures to ensure safe operations and prevent pollution; -regulations contain extensive rules on specific operating procedures (Parts 4 & 5)		-procedures must cover initial startup, normal operations, emergency operations, normal shutdowns, safety and environmental consequences of any deviations, control of hazardous chemicals, etc; -operating procedures must be accessible to all involved employees and must be reviewed and updated periodically – reviews and changes must be documented and communicated to responsible personnel;
<i>Quality Assurance and Mechanical Integrity</i>	NA	- regulations contain listing of processes for ensuring and maintaining the integrity of all facilities, structures, installations; -regulations also contain listing of structures, facilities, equipment critical to safety and environmental protection; - operator shall ensure that all wells, installations, equipment and facilities are designed, constructed and operated to prevent incidents and waste; -must ensure comprehensive inspections and any defects are rectified immediately;	- Construction of mobile offshore units with associated systems and equipment must be based on the best, established international practices, technology and standards, and be fitted with the equipment necessary for the fulfilment of the purpose of the current Arctic sea area; -equipment must be located, designed and used such that any safety and health risks are reduced; - mobile offshore installations must meet all IMO requirements;	- written instructions required to ensure mechanical integrity and safe operation of equipment through inspection, testing, and quality assurance; - mechanical integrity program must encompass all equipment and systems used to mitigate environmental or safety consequences; - design, fabrication, maintenance of equipment/systems must comply with manufacturer's specifications; - inspections and tests must be documented and carried out according to BSEE regs and manufacturer recommendations; -equipment and systems deficiencies must be corrected before further use;
<i>Documentation & Reporting</i>	-responsible party must ensure data on health, safety	- application for authorization must include description of scope	- site survey requirements with respect to drilling operations	- requires program safety and environmental information be

<i>Safety Element</i>	<i>Norway</i>	<i>Canada</i>	<i>Greenland</i>	<i>United States</i>
	<p>and the environment are collected, processed and used for monitoring and checking technical, operational and organizational factors;</p> <ul style="list-style-type: none"> - information must be retained for as long as necessary for prudent operation; - regulations also spell out what kind of data and information are to be collected and retained -responsible party must identify information necessary to carry out activities and ensure it is communicated to relevant users in a timely manner; -regulations spell out information to be reported to the Climate and Pollution Agency and the Petroleum Safety Authority; -hazard and accident situations must be recorded and examined and specified events reported to Petroleum Safety Authority; 	<p>of proposed activities, execution plan, safety plan, environmental protection plan, contingency plans, and a description of decommissioning, abandonment and restoration methods;</p> <ul style="list-style-type: none"> - procedures and scope of safety plans and environmental protection plans are detailed out; - operator must ensure the National Energy Board is notified of any incident or near-miss as soon as possible and causes investigated and corrective action taken; -results of analyses must be submitted to the Board; -operator must submit an environmental report (with prescribed information) annually to the Board; -operator must have and maintain documents describing management system processes, ensure they are current, valid and approved, and personnel are aware of their roles and responsibilities related to these processes; - operator must keep a copy of authorizations, well approvals and all other approvals and plans required under the Regulations; - operator must retain copies of all operating manuals and other procedures and documents necessary to operate safely without pollution - these must be readily accessible at each installation; 	<p>must include information on foundation stability, anchor suitability, well and anchor position limitations with respect to e.g. pipelines, cables, etc.;</p> <ul style="list-style-type: none"> - 24 hour drilling activity reports to be provided daily to Mineral License and Safety Authority (MLSA); - Government may issue enforcement notice to provide information on environmental damage or an imminent danger of environmental damage –can also order operator to conduct relevant studies, analyses and measurements; - licensees required to submit to authorities any information needed regarding operations and activities; - operator required to notify MLSA of accidents and other safety and health aspects; - health and safety “statements” regarding mobile offshore units must include identification, assessment and demonstrated reduction of risks – statements must be updated and accessible to plant operators and employees; 	<p>developed and maintained for any facility subject to SEMS;</p> <ul style="list-style-type: none"> - recommendations in hazard analysis must be resolved and documented; - SEMS program must establish and implement safe work practices to minimize the risks associated with operating, maintenance, and modification activities; - operators must ensure contractors have written safe work practices –to be made available to BSEE on request; - must document that contracted employees are knowledgeable and experienced; - with certain exceptions, records and documents to be retained for 6 years; - must document and date all management of change provisions and retain for 2 years; - SEMS program elements must be properly documented and available at field and office locations, as appropriate for each program element;

Safety Element	Norway	Canada	Greenland	United States
Communication	- responsibility and authority shall be unambiguously defined and coordinated at all times with the necessary reporting lines clearly established; - internal (communication) requirements must put regulatory requirements in concrete terms;	- management system must include (communication) processes for the internal reporting and analysis of hazards, minor injuries, incidents and near-misses and for taking corrective actions to prevent their recurrence;	NA	- written descriptions of safety and environmental policies and organizational structure must be developed and endorsed that define responsibilities, authorities, and lines of communication required to implement the SEMS program;

Comparable information on regulations governing safety systems for Russia, Faroe Islands and Iceland were not available to PAME for this table. Regulations for Norway are from the Management Regulations⁴⁶, for Canada they are from the Canada Oil and Gas Drilling and Production Regulations⁴⁷ or the Canada Oil and Gas Operations Act⁴⁸, Greenland's regulations and guidance come from the Executive order on health and safety⁴⁹ or the Mineral Resources Act⁵⁰, and the exploration drilling guidelines (DG)⁵¹, and rules for the United States are from the Code of Federal Regulations (CFR)⁵². The text of these regulations can be viewed in the online Supporting Documents at www.pame.is.

⁴⁶ Regulations Relating to Management and the Duty to Provide Information in the Petroleum Activities and at Certain Onshore Facilities (The Management Regulations) http://www.ptil.no/management/category401.html#_Toc280619385 Chapter 2 Section 6 Management of health, safety and the environment cf. [Section 17 of the Framework Regulations](#)

⁴⁷ Canada Oil and Gas Drilling and Production Regulations <http://laws-lois.justice.gc.ca>

⁴⁸ [Canada Oil and Gas Operations Act](#). R.S., 1985, c. O-7, s. 1; 1992, c. 35, s. 2. <http://laws-lois.justice.gc.ca/eng/acts/O-7>

⁴⁹ Executive order on health and safety in connection with offshore hydrocarbon activities in Greenland.(in Danish) <http://dk.nanoq.gl/Service/Hoeringsportal/Bekendtgoerelser/2011/sikkerhed%20og%20sundhed%20pa%20mobile%20offshoreanlaeg%20ifb%20med%20offshore%20kulbrinteaktiviteter%20i%20Grønland.aspx>

⁵⁰ Greenland Parliament Act of 7 December 2009 on mineral resources and mineral resource activities (the Mineral Resources Act), chapter 13, 14, 15: environmental protection, environmental liability, environmental impact assessment, chapter 17: health and safety for offshore installations. http://www.govmin.gl/images/stories/faelles/mineral_resources_act_unofficial_translation.pdf

⁵¹ MLSA exploration drilling guidelines (DG) http://www.govmin.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf

⁵² Code of Federal Regulations 30 CFR Subpart S, Safety and Environmental Management Systems (1010–0186), including Form BSEE–0131, Performance Measures Data <http://ecfr.gpoaccess.gov/cgi/t/text/text-idx?c=ecfr&sid=a6aca655228a4f5d6ca2a70b35270de2&rgn=div6&view=text&node=30:2.0.1.2.2.19&idno=30>

Appendix B - Deepwater Horizon Findings and Recommendations and Results of Regulatory Reviews and Reforms from the HSE Management Systems and Safety Culture Workshops

This Appendix contains a summary of selected Deepwater Horizon investigations and the results of regulatory hearings, reviews and reforms undertaken in the aftermath of the Deepwater Horizon accident that were presented at the two offshore oil and gas workshops held in support of this project. The full reports with all presentations and discussions are published separately by PAME (PAME, 2013a⁵³ and 2013b⁵⁴). These findings and recommendations are the opinions of experts and stakeholders at the workshops.

These workshops were a valuable source of information for PAME in developing this report.

After the Deepwater Horizon/Macondo well disaster in the Gulf of Mexico April-July 2010, many investigations were begun by government appointed bodies and regulators (See Appendix C).

While most of these investigative findings and recommendations are specifically aimed at the Deepwater Horizon/Macondo well incident, the findings clearly show the root causes of the accident are common to all systems failure accidents and indicate problems with safety culture and safety management systems in the offshore petroleum industry in particular.

At the invitation of PAME, several participants in the HSE Management Systems and Safety Culture workshops presented the results of national investigations into the Deepwater Horizon/Macondo well disaster or other results from subsequent regulatory reviews. The first five of the summaries are from these workshop presentations.

1. Macondo Well–*Deepwater Horizon* Blowout: Lessons for Improving Offshore Drilling Safety Offshore by the Committee for Analysis of Causes of the Deepwater Horizon Explosion, Fire, and Oil Spill to Identify Measures to Prevent Similar Accidents in the Future, National Academy of Engineering, December 2011
2. Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling, Report to the President by the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling⁵⁵, January 2011
3. State of Alaska Oil and Gas Conservation Commission Hearings on Drilling Safety September 15-16, 2011
4. National Energy Board of Canada, Arctic Drilling Review
5. Petroleum Safety Authority Report--The Deepwater Horizon accident—assessment and recommendations for the Norwegian Petroleum Industry

Additional information was drawn from published reports including:

⁵³ http://www.pame.is/images/PAME_Ministerial_2013/HSE_Workshop_Report_10-12_June_2012.pdf

⁵⁴ http://www.pame.is/images/PAME_Ministerial_2013/Safety_Culture_Workshop_Report_16_Sep_2012.pdf

⁵⁵ National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling Report to the President www.oilspillcommission.gov

- Petroleum Safety Authority Report--The Deepwater Horizon accident—assessment and recommendations for the Norwegian Petroleum Industry
- Department of Interior (DOI) Assessment of Shell 2012 Arctic Drilling Program, March 8, 2013

Macondo Well–Deepwater Horizon Blowout: Lessons for Improving Offshore Drilling Safety Offshore⁵⁶ by the Committee for Analysis of Causes of the Deepwater Horizon Explosion, Fire, and Oil Spill to Identify Measures to Prevent Similar Accidents in the Future, National Academy of Engineering, December 2011

This committee was formed to report on the loss of the Macondo well and Deepwater Horizon drilling vessel in response to a request from the Secretary of Interior of the United States to the National Academy of Engineering.

Findings

Lack of fail-safe design, testing, training, and operating practices, aboard the rig contributed to the loss of rig and life.

Other contributing factors in the accident include:

- multiple non-integrated and flawed decisions,
- no systems approach to safety,
- no one looking at totality of the operation,
- no one monitoring the margins of safety,
- no one looking at the totality of risk.
- no strong safety culture
- failure by the operator and contractors to understand changes and consequences
- there was apparent confusion between systems and occupational safety
- unclear accountability

Management and Safety Culture

- The lack of a strong safety culture resulting from a deficient overall systems approach to safety is evident in the multiple flawed decisions that led to the blowout.
- Industrial management failed to appreciate or plan for the safety challenges presented by the Macondo well.
- The complex structure of the offshore oil and gas industry and the divisions of technical expertise impacts the ability to perform and maintain an integrated assessment of the margins of safety.

Recommendations for Industry

- Operating companies should be held responsible and accountable for well design, well construction, and suitability of rig and safety equipment. The drilling contractor should be held responsible and accountable for the operation and safety of the offshore equipment.
- Industry should
 - Greatly expand R&D to improve overall safety of offshore drilling.
 - Significantly expand the formal education and training of industry personnel engaged in offshore drilling to support proper implementation of system safety.

⁵⁶ <http://www.nae.edu/Activities/20676/deepwater-horizon-analysis.aspx>

- Foster an effective safety culture through consistent training, adherence to principles of human and organizational factors, system safety and continued measurement through leading indicators.
- Ensure timely access to demonstrated capping and containment capabilities.

Recommendations for Regulators

- Improve corporate and industry-wide systems for reporting safety-related incidents.
- Designate a single U.S. government agency with responsibility for ensuring an integrated approach for system safety for all offshore drilling activities.
- Significantly expand the formal education and training of regulatory personnel engaged in offshore drilling roles.
- Implement a hybrid regulatory system integrating a limited number of prescriptive elements into a pro-active, goal-oriented risk management system.

Deep Water: The Gulf Oil Disaster and the Future of Offshore Drilling, Report to the President by the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling⁵⁷, January 2011

This report commissioned by the President of the United States after the Macondo well blowout and resultant enormous Gulf of Mexico oil spill, contained a forward looking section on the challenges of working in Frontier areas, including the Arctic, in anticipation of the resumption of oil and gas operations in the U.S. Chukchi and Beaufort Seas.

Findings:

- The Deepwater Horizon disaster was foreseeable and preventable
- The immediate causes of the Macondo well blowout can be traced to a series of identifiable mistakes made by BP, Halliburton, and Transocean
- The decisions made by these companies reveal systemic failures in risk management and raise questions about the safety culture of the industry.

Special Challenges in the Arctic

- Cold, dark, remote, extreme weather, inadequate charting, communications, training, infrastructure, underdeveloped technology appropriate to conditions, lack of knowledge about the ecosystems, very vulnerable environment, and indigenous populations dependent upon healthy marine mammals, fish, birds, etc.

Recommendations for the Arctic

- Drilling must be done with the utmost care because of the sensitive Arctic environment
- Safety Culture: The oil and gas industry must adopt a “culture of safety” as a collective responsibility with a focused commitment to constant improvement and zero failure rate and set up mechanisms to implement
- Incident/near-miss reporting should be public
- Providing protection for “whistleblowers” for safety problems
- Develop management system incorporating “safety case” approach

⁵⁷ National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling Report to the President www.oilspillcommission.gov

State of Alaska Oil and Gas Conservation Commission (AOGCC) Hearings on Drilling Safety

Alaska Hearings on Drilling Safety September 15-16, 2011 were held to assess if the State of Alaska needed to change their regulations in the aftermath of the Deepwater Horizon incident. A study was done for the AOGCC and discussed at the hearing. The Report findings included:

Don't blame deep water. The loss of well control and subsequent systems failure that led to explosions, fire, and sinking, and loss of life and a massive oil spill, is not just a problem restricted to deepwater type of operations. It can happen in any frontier area where operations are complicated and complex, such as the Arctic offshore.

Demand a safety culture. Safety culture and continual improvement for regulators and operators, from every level, is not an optional extra. It must be demanded, guided, measured, verified, and improved.

Eliminate regulatory complexity. Complex regulations and overlaps and gaps, made understanding compliance and communication responsibility and accountability difficult.

Conduct inspections, enforce regulations, and monitor performance. Violations of regulations by the operator, soft penalties, lack of inspections by the regulator combined with, poor monitoring of the operators performance, greatly increases the risk for a major accident. Performance monitoring is critical for identifying problem trends. Monitoring can encompass many things such as incidents, near misses, system failures, well integrity issues, kicks, gas releases and can include workers surveys. A key issue is not just data, but *how the data is analyzed and used*.

Use safety approach that fits your operators. A Safety Case works for responsible operators, but a prescriptive focus might work better for other operators and operations. Either, or a hybrid, of the two systems can work as long as the regulator continues to recognize who you they dealing with, which system they are using, and why, and what it's drawbacks can be in the given situation.

Keep the regulator focused on regulating. Non-regulatory responsibilities, placed on the agency that enforces the law, reduces the ability of the regulators to do their jobs and it increases safety concerns. The responsibility of regulating should be consolidated into a competent agency or body. Non-regulatory responsibilities should be assigned to other agencies or bodies. The regulator needs to make sure it regulates and not operates.

Hold the right people accountable. Operators and the contractors have to have very clear lines of responsibility and accountability and few regulators do enough to influence and oversee contractor behavior. Accountability for the regulator includes eliminating regulatory gaps and overlaps where possible, and understanding shared responsibilities.

Require a blowout contingency plan. A reviewed and approved blowout contingency plan that is appropriate for the location and well conditions is needed.

Develop an international database and international standards. An international database on incidents with complete, accurate and verifiable data is needed, as is the development of international standards.

Other testimony at the hearings emphasized additional issues:

- Compensate key regulatory staff adequately
- Insulate key regulators from politics

- Keep regulatory staff technically trained
- Have back-up rig for relief well
- Require Arctic-specific BOP training of operators, contractors and inspectors.
- View the Arctic as an international zone

Many of these recommendations are already in place for Alaska,

- a robust inspection program,
- already acquire and analyze performance data for trends,
- already maintain focus on regulating, and
- already have a system in place that insulates regulators from politics.

National Energy Board of Canada (NEB) Arctic Drilling Review

In response to the disaster in the Gulf of Mexico, the NEB initiated a review of the safety and environmental requirements for offshore drilling in Canada's unique Arctic environment.

Scope of the Arctic Offshore Drilling Review⁵⁸

- Drilling safely while protecting the environment
- Responding effectively when things go wrong
- Lessons learned from other jurisdictions
- Filing Requirements

Key Community Concerns (not a comprehensive list)

- Same season relief well capability
- Use of dispersants
- Spill response capability and infrastructure
- Training
- Compensation for Northern residents in the event of a spill
- Wildlife/Environmental Monitors

Community residents said all species, such as beluga, narwhal, char, Arctic cod, polar bear, seal, and walrus, are connected and important to people in the North and they were concerned that a blowout could completely change their way of life.

A common thread was found in analyses of major accidents: a neglect of, or even an absence of, processes and procedures to identify, mitigate, or eliminate potential risks. Beneath that deficiency lies an even deeper pattern of organizational cultures that did not put safety first.

Of the findings of the review, Four Key Findings were identified.

Key finding 1: The root cause of most industrial accidents, such as blowouts in offshore drilling, is the lack of a broadly shared safety culture.

Four cultural factors were found in several major industrial accidents.

- tolerance of inadequate systems and resources

⁵⁸ <http://www.neb-one.gc.ca/clf-nsi/rthnb/pplctnsbfrthnb/rctcffshrdllngrvw/rctcffshrdllngrvw-eng.html>

- deviation from safety policy becomes normal and accepted
- complacency
- work pressure

Response

1). Any company wishing to drill in the Canadian Arctic must demonstrate that they have a strong safety culture. Filing Requirements include safety culture provisions (and indicators) such as:

- Accountable officer, responsible for the management system
- Annual report on performance of the management system
- Policy and process for internal reporting of hazards

Key finding 2: Reporting and Availability of Information: The NEB's regulatory regime provides the tools required to protect the safety of Northerners and workers, and protect the Arctic environment.

Response

2). Applicants can agree in writing to make public their:

- Safety Plans;
- Contingency Plans;
- Emergency Response Plans (if such plans exist separately from other Contingency Plans); and
- Environmental Protection Plans.

...[local] people understand that energy is important and there is a need for energy development, but this development cannot occur anywhere at any cost. It must be done the right way.

Key Finding 3: Reaffirmed the Canadian Same Season Relief Well Requirement:

Response

3). The Board has re-affirmed the NEB Same Season Relief Well policy. A company must demonstrate how they would meet or exceed the intended outcome of a single season relief well policy, i.e., to kill an out-of-control well in the same season in order to minimize harmful impacts on the environment.

Key Finding 4: Effective response capability is essential with industry leading and providing Community training before an application is filed.

Response

4). Industry agrees that they have a key role to play, commencing with Community training before an application is filed.

Filing Requirements

Filing Requirements for future Arctic offshore drilling applications were developed as a result of the Drilling Review and specify the information to be submitted to in support of an offshore drilling application. They require that an applicant must demonstrate that it has complied with applicable legislation and regulatory requirements. The Filing Requirements should be read in association with the Canadian Oil and Gas Operations Act, regulations and guidelines.

Elements of a Filing Requirement

- Context or guidance

- o used as necessary to clarify key filing requirements
- Goal
 - o always provided
 - o stated as an outcome
 - o stated as concisely as possible
- Filing Requirement
 - o describes documents or information to be filed with the Board

Petroleum Safety Authority Report--The Deepwater Horizon accident—assessment and recommendations for the Norwegian Petroleum Industry

The Petroleum Safety Authority of Norway (PSA) commissioned a report, “*The Deepwater Horizon accident: Causes, learning points and recommendations for the Norwegian continental shelf*”, and established a project team to look at improvement opportunities from lessons learned after the Deepwater Horizon incident. This team developed a study “*The Deepwater Horizon accident—assessment and recommendations for the Norwegian Petroleum Industry*.”⁵⁹

The PSA report indicates that the Deepwater Horizon accident is a wake-up call to the Norwegian petroleum sector. PSA concluded that the accident must lead to big improvements in managing major accident risk, and that safety culture is lacking throughout the industry (PSA, 2011).

PSA concluded the Deepwater Horizon accident demonstrates the need for improved risk management and processes which lead to more **robust** solutions--ones with built-in safety margins--a degree of resiliency--which enables the operator to handle human and technical error, operational non-conformities, unexpected conditions, the pressure of events, etc. Robust solutions also contribute to the effective identification and management of hazardous conditions, and to ensuring that sufficient time is available to bring such conditions under control. The need for robust solutions applies to technology, capacity, expertise, organization and management in every phase (PSA, 2011).

The Deepwater Horizon accident raises serious questions about the integrity, modernity and efficiency of government regulation, monitoring and influence. That confirms the need for the PSA, on a continuous basis, to continue evaluating and improving the way it seeks to influence safety in the petroleum industry, and the effect of such an influence.

From their study of the Deepwater Horizon accident, PSA came up with 4 Priorities areas:

- Managements role in risk management;
- Barrier management;
- Group/Individual risk (occupational noise etc.); and
- Prevention of harm to external environment

Two main issues identified for PSA from the Deepwater Horizon accident that are most relevant for HSE Management Systems are:

⁵⁹ The Deepwater Horizon accident—assessment and recommendations of the Norwegian Petroleum Industry
http://www.ptil.no/getfile.php/PDF/DwH_PSA_summary.pdf

- **Barrier management:** *Industry is responsible for Barrier Management and Well Monitoring.* PSA examined the integrity of 1745 wells of all types and their maintenance—25% had only one barrier and some had two barriers but they were completely deteriorated. This called for immediate action on the part of the operator.
- **Management's role in managing major risk:** *PSA needs information on risks and development of risks in the industry.*

The Deepwater Horizon accident reaffirms the need for the PSA and the industry to continue giving high priority to the work of improving barrier management, and ensuring that this commitment covers all types of barrier elements.

Given recommendations made in the wake of the Deepwater Horizon accident, PSA is looking at *major risk* with the use of risk analysis processes and tools. They use and are developing risk analysis processes and tools related to

- the well planning phase (well design and drilling plan)
- the need for better handling of changes to the drilling plan during the operational phase.

In Norway there are 3 legs to safe operations--labor, industry, and the regulator. All have duties and responsibilities. OLF is the labor organization and wrote a report on the Deepwater Horizon and published it June 6, 2012 "Summary Report--Deepwater Horizon: Lessons Learned and Followup." A Tripartite Regulatory Safety Forum is organized every year with all three parties including many representatives to discuss all of these issues.

PSA feels that there has been a positive change in Norway's regulation of offshore oil and gas activities with more focus on major accident risk.

Bureau of Safety and Environmental Enforcement (BSEE) Historic Accident Investigations

In a BSEE analysis of 1000 Accident Investigations in the U.S. Outer Continental Shelf (PAME 2013a, p. 21), failure in addressing at least one of these safety management elements was found as a contributing/root cause in each of the 1000 incidents evaluated.

- Hazard Analysis
- Operating Procedures
- Quality Assurance and Mechanical Integrity
- Management of Change

Department of Interior Assessment of Shell 2012 Arctic Drilling Program, 2013

Recommendations

Industry Operations

- All phases of an offshore Arctic program – including preparations, drilling, maritime and emergency response operations – must be integrated and subject to strong operator management and government supervision.
- Arctic offshore operations must be well-planned, fully ready and have clear objectives in advance of the drilling season. "There should be no loose ends or unnecessary improvisation with critical equipment, assets or drilling plans once operations are scheduled to begin."
- Operators must maintain strong, direct management and supervision of their contractors.

- Operators must tailor their management and supervision programs to Arctic conditions, and the programs must cover preparations in advance of the drilling season and maritime operations as well in-theater drilling operations.
- Operators must understand and plan for the variability and challenges of Alaskan conditions. Reliable weather and ice forecasting play a significant role in ensuring safe operations offshore Alaska, including but not limited to the Arctic.
- Respect for and coordination with local communities. It is an operator's safety and environmental performance that is the ultimate measure of how well and responsibly the company works with North Slope communities and Alaska Natives.

Government Supervision

- Continued strong coordination across government agencies is essential in the permitting and regulatory process.
- Industry and government must develop an Arctic-specific model for offshore oil and gas exploration in Alaska. Industry and government need to continue to develop and refine standards and practices that are specific to the unique and challenging conditions associated with offshore oil and gas exploration

Appendix C: Deepwater Horizon and Other Investigations

Table A2 From Oil and Gas Producers International

Investigative Body	Reports and Other Documents
United States District Court for the Eastern District of Louisiana	<u>Partial Consent Decree between the USA and Transocean (19 February 2013)</u> <u>Amendment to the Partial Consent Decree between the USA and Transocean (19 February 2013)</u>
<u>Deepwater Horizon Joint (BOEMRE-USCG) Investigation of Deepwater Horizon</u>	<u>Vol.1 (U.S. Coast Guard-Joint Investigation Team) draft report to Commandant</u> 22 April 2011 <u>IADC letter of 31 May 2011 to the Commandant, USCG, regarding the Vol. 1 draft report to Commandant</u> 31 May 2011 <u>BOEMRE Final Report regarding Macondo Well Blowout</u> 14 September 2011 <u>Deepwater Horizon Joint Investigation Team Releases Final Report</u> 14 September 2011 <u>Volume I – USCG Final Action Memo on Vol I</u> 14 September 2011 <u>Volume I – Enclosure to Final Action Memo</u> 14 September 2011 <u>Deepwater Horizon Report Appendices</u> September 2011
<u>Montara Commission of Inquiry</u>	<u>Report of the Montara Commission of Inquiry</u> 17 June 2010 <u>Final Government Response to the Report of The Montara Commission Of Inquiry</u> 25 May 2011
<u>BP</u>	<u>Deepwater Horizon Accident Investigation Report</u> 8 September 2010
<u>Transocean</u>	<u>Macondo Well Incident: Transocean Investigation Report, Vol. I</u> June 2011 <u>Macondo Well Incident: Transocean Investigation Report, Vol. II</u> June 2011
<u>The National Commission on the Deepwater Horizon Oil Spill and Offshore Drilling</u>	The Staff working papers were written by the staff of the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling for the use of members of the Commission. They do not necessarily reflect the views of the Commission or any of its members. <u>A Brief History of Offshore Oil Drilling</u> 23 August 2010 <u>Decision-Making Within the Unified Command</u>

	11 January 2011	<u>The Amount and Fate of the Oil</u>
	11 January 2011	<u>The Use of Surface and Subsea Dispersants During the BP Deepwater Horizon Oil Spill</u>
	11 January 2011	<u>The Challenges of Oil Spill Response in the Arctic</u>
	11 January 2011	<u>Stopping the Spill: The Five-Month Effort to Kill the Macondo Well</u>
	11 January 2011	<u>Response/Clean-Up Technology Research & Development and the BP Deepwater Horizon Oil Spill</u>
	11 January 2011	<u>The Story of the Louisiana Berms Project</u>
	11 January 2011	<u>Industry's Role in Supporting Health, Safety, and Environmental Standards: Options and Models for the Offshore Oil and Gas Sector</u>
	12 January 2011	<u>Liability and Compensation Requirements under the Oil Pollution Act</u>
	11 January 2011	<u>Scientific Research to Support Oil and Gas Decision Making: Evolution of the Department of the Interior's Environmental Studies Program</u>
	24 February 2011	<u>The National Environmental Policy Act and Outer Continental Shelf Oil and Gas Activities</u>
	8 February 2011	<u>Offshore Drilling in the Arctic: Background and Issues for the Future Consideration of Oil and Gas Activities</u>
	7 February 2011	<u>Unlawful Discharges of Oil: Legal Authorities for Civil and Criminal Enforcement and Damage Recovery</u>
	24 February 2011	<u>Long-Term Regional Restoration in the Gulf: Funding Sources and Governance Structures</u>
	24 February 2011	<u>Rebuilding an Appetite for Gulf Seafood after Deepwater Horizon</u>
	7 February 2011	<u>Natural Resource Damage Assessment: Evolution, Current Practice, and Preliminary Findings Related to the Deepwater Horizon Oil Spill</u>
	7 February 2011	<u>Continuous Improvement Is Essential: Leveraging Global Data and Consistent Standards for Safe Offshore Operations</u>
	11 January 2011	<u>A Competent and Nimble Regulator: A New Approach to Risk Assessment and Management</u>
	8 February 2011	

	<u>Federal Environmental Review of Oil and Gas Activities in the Gulf of Mexico: Environmental Consultations, Permits, and Authorizations</u> 12 January 2011 <u>The History of Offshore Oil and Gas in the United States (long version)</u> 11 January 2011 <u>Chief Counsel's Report</u> 17 February 2011 <u>Final report of the <i>National Commission on the Deepwater Horizon Oil Spill and Offshore Drilling</i></u> 11 January 20
<u>Oil Spill Commission Action</u>	The oil Spill Commission <i>Action</i> (OCSA) project is an outgrowth of the National Commission (above) supported of many of the original Commissioners. <u>OSCA Assessment Report on the status of implementation of the Commission's recommendations (17 April 2012)</u>
<u>Republic of the Marshall Islands</u>	<u>DEEPWATER HORIZON MARINE CASUALTY INVESTIGATION REPORT</u> (low resolution version) 17 August 2011
<u>Harvard Law School Emmet Environmental Law and Policy Clinic</u>	<u>Recommendations for Improved Oversight of Offshore Drilling Based on a Review of 40 Regulatory Regimes (June 2012)</u> <u>Appendix – Regulatory Programs and Organizations Analyzed January-April 2012</u>
<u>University of California, Berkeley — Center for Catastrophic Risk Management</u>	<u>"<i>Deepwater Horizon Study Group Final Report on the Investigation of the Macondo Well Blowout</i>"</u> 1 March 2011
<u>U.S. Chemical Safety Board Investigation of Deepwater Horizon</u>	Investigation currently underway
<u>National Academy of Engineering—Analysis of Causes of Deepwater Horizon Explosion, Fire, and Oil Spill to Identify Measures to Prevent Similar Accidents in the Future</u>	<u>Interim Report on Causes of the Deepwater Horizon Oil Rig Blowout and Ways to Prevent Such Events</u> 16 November 2010 <u>Macondo Well-Deepwater Horizon Blowout: Lessons for Offshore Drilling Safety (Prepublication version)</u> 14 December 2011

Transportation Research Board	Transportation Research Board Special Report 309: <u>Evaluating the Effectiveness of Offshore Safety and Environmental Management Systems</u> June 2012
<u>Petroleum Safety Authority Norway – Macondo Incident</u>	<u>Preliminary conclusions by the Petroleum Safety Authority Norway (PSA) and action recommended after the Deepwater Horizon accident (English summary)</u> 9 June 2011 <u>SINTEF Executive Summary of report commissioned by the Petroleum Safety Authority</u> May 2011
Norwegian Oil Industry Association (OLF) <u>Deepwater Horizon – lessons learned and follow up</u>	<u>OLF’s Deepwater Horizon Report – In English (84 pages)</u> <u>OLF’s summary Report – In English (20 Pages)</u> June 2012
<u>UK Health and Safety Executive – Deepwater Horizon incident in the Gulf of Mexico</u>	The Health and Safety Executive’s Offshore Division is monitoring the situation in the Gulf of Mexico following the fatal explosion on the Deepwater Horizon drilling rig in April 2010 and has created a website (link at left) to report on its findings, observations and actions.
UK Ministerial commissioned Independent Review for the Deepwater Horizon/Macondo incident	<u>Offshore Oil and Gas in the UK – an independent review of the regulatory regime December 2011</u> Government Response to an Independent Review of the Regulatory Regime, Department of Energy & Climate Change, December 2012
International Organization for Standardization – Subcommittee on Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries	<u>Proposed ISO/TC 67 programme for drilling, well construction and well operations standards, resulting from the Montara and Macondo accidents (N 1119)</u> 1 March 2011

International Maritime Organization (IMO)	Casualty Statistics and Investigation, Report of the Correspondence Group on Casualty Analysis (FSI 21/5) addressing, <i>inter alia</i> , the explosion, fire and loss of the Mobile Offshore Drilling Unit Deepwater Horizon
<u>International Association of Oil and Gas Producers (OGP)</u>	<u>International recommendations on well incident prevention, intervention and response</u> <u>Global Industry Response Group recommendations (Summary)</u> May 2011 <u>Oil Spill Response</u> May 2011 <u>Capping & Containment</u> May 2011 <u>Deepwater Wells</u> May 2011

Appendix D – List of HSE Guidance and Safety Culture documents

HSE Guidance

Iris and U of Stavanger for PSA www.ptil.no/getfile.php/PDF/high-north.pdf
Technology and Operational Challenges in the High North
October 2011

Transportation Research Board of the National Academies
<http://www8.nationalacademies.org/cp/projectview.aspx?key=49165>
Effectiveness of Safety and Environmental Management Systems for Outer Continental Shelf Oil and Gas Operations Interim Report 2011
<http://onlinepubs.trb.org/onlinepubs/sr/srSEMSInterimReport.pdf>

Petroleum Safety Authority of Norway
The Thought Process
<http://www.ptil.no/getfile.php/z%20Konvertert/Products%20and%20services/Publications/Dokumenter/tankekraftengelsk.pdf>
HSE and Culture
<http://www.ptil.no/getfile.php/z%20Konvertert/Products%20and%20services/Publications/Dokumenter/hescultureny.pdf>

Greenland Mineral License and Safety Authority (MLSA)
Exploration Drilling Guidelines May 2011
http://www.govmin.gl/images/stories/petroleum/110502_Drilling_Guidelines.pdf
Terms of approval for an exploration drilling program;
<http://www.govmin.gl/petroleum/approval-of-activities/exploration-drilling>

U.S. Bureau of Safety and Environmental Enforcement (Rules and Guidance)
[SEMS Fact Sheet](#)
[SEMS II Final Rule](#) Revisions to Safety and Environmental Management Systems at 30 CFR Part 250 Oil and Gas and Sulphur Operations in the Outer Continental Shelf. Presents and explains new Safety and Environmental Management Systems rule and changes to existing regulations.
<http://www.gpo.gov/fdsys/pkg/FR-2013-04-05/pdf/2013-07738.pdf> **SEMS Implementation IPD 2013-01** Interim Policy Document January 3, 2013. Explains the policies and responsibilities of BSEE SEMS program management and implementation.

National Energy Board of Canada
Advancing Safety in the Oil and Gas Industry - Draft Safety Culture Framework,
November 1, 2013 <http://www.neb-one.gc.ca/clf-nsi/rsftyndthnvrnmnt/sfty/sftyelctr/sftyelctr-eng.html>

OSPAR

AOOGG: Systems Safety Management and Safety Culture-Report, final version Feb 21, 2014
SAO meeting March 2014

Recommendation 2003/5 to Promote the Use and Implementation of Environmental Management Systems by the Offshore Industry 2003

International Regulators Forum IRF www.irfoffshoresafety.com/:

[Safety Culture & Leadership Improvement](#) Report

[Safety Culture Maturity](#) Mark Fleming for IRF

[Communiqué](#) International Regulators' Offshore Safety Conference – *Preventing the Next Black Swan* 25 October 2013

North Sea Offshore Authorities Forum (NSOAF)

ICRARD (International Committee on Regulatory Research and Development)

www.icrard.org primarily has information on HSE-related research and development projects in the USA, Canada, the United Kingdom and Norway.

G-20

Global Marine Environment Protection GMEP: Best Practices

<http://www.g20gmp.org/participating-countries/567-2/>

OGP

'Guidelines for the Development and Applications of Health, Safety and Environmental Management Systems' 2003

2012

- **Catalogue of international standards used in the oil & gas industry**

2011

- **Managing health for field operations in oil and gas activities**
- **Process safety: recommended practice on key performance indicators**
- **Environmental performance in the E&P industry – 2010 data**
- **HSE guidelines for metocean surveys including Arctic areas**
- **Human factors engineering in projects**
- **Safety performance indicators – 2010 data**
- **Health and Safety data reporting system users guide – 2010 data**
- **Substance Misuse: a guide for managers & supervisors in the oil & gas industry**

UK Health and Safety Executive

- **Reducing Error and Influencing Behaviour**
- **Improving Maintenance; A guide to reducing human error**
- **Culture & Work Environments Elements**

Step Change <http://stepchangeinsafety.net/stepchange/>

Changing Minds - A Practical Guide for Behavioural Change in the Oil & Gas Industry

Shell Exploration & Production

Hearts and Minds Tools, 2002

AOOGG: Systems Safety Management and Safety Culture-Report, final version Feb 21, 2014
SAO meeting March 2014

Human Engineering for the Health & Safety Executive
Culture & Work Environments Elements [Research Report 365](#) 2005

International Organization for Standardization Documents

ISO TC 67 Arctic Offshore Structures

**ISO 17776 Petroleum and natural gas industries - Offshore production installations -
Guidelines on tools and techniques for hazard identification and risk assessment**

ISO 14001:1996, Environmental management systems - Specification with guidance for use

**ISO14004:1996, Environmental management systems - General guidelines on principles,
systems and supporting techniques**

http://www.iso.org/iso/iso_catalogue/catalogue_ics/catalogue_detail_ics.htm?csnumber=31807

American Petroleum Institute

API RP 75 and 74L HSE Management Systems

<http://publications.api.org/Exploration-Production.aspx>

International Association of Drilling Contractors (IADC): www.iadc.org

Health Safety and Environment Case Guidelines for Mobile Offshore Drilling Units

November 2011

E&P FORUM

**Guidelines for the Development and Application of Health, Safety and Environmental
Management Systems Report No. 6.36/210**

IADC HSE Case Guidelines For both offshore and onshore drilling rigs

www.iadc.org/hsecase/index.html

Appendix E – Some Current Safety Initiatives

Current work (please visit the websites of the responsible regulators for updates)

Canada

National Energy Board (NEB) Canada www.neb-one.gc.ca:

The NEB Strategic Plan 2012-2015 will focus on developing guidance for the D&P Regulations on Data acquisition, Incident reporting, Geotechnical considerations, Well abandonment and suspension, and Financial responsibility, as well as, on creating performance measures and audit protocols.

- 1) performance safety metrics that influence hazards identification and risk management;
- 2) senior leadership and its role in safety culture; and
- 3) management systems effectiveness and implementation.

The NEB, C-NLOPB, and C-NSOPB developed a White Paper on “Advancing Safety in the Oil and Gas Industry - Draft Safety Culture Framework” and released it for public comment on November 1, 2013 with comments due by January 30, 2014. The paper states NEB’s collective expectation of the companies they regulate and outlines a draft safety culture framework.

United States

Bureau of Safety and Environmental Enforcement US BSEE www.bsee.gov:

- Safety Culture Policy Draft (comments closed March 20, 2013)
- The Safety and Environmental Management Systems (SEMS) II final rule (April 4, 2013) (with greater employee participation, empowering field level personnel with safety management decisions, and strengthening supervision by requiring audits to be conducted by accredited third-parties.)
- Ocean Safety Institute June 2013
- Rule Making Process for Arctic Standards, December 2013 with BOEM.
- Near-Miss database with Bureau of Transportation Statistics. Voluntary and anonymous reporting to BTS but BSEE will publish statistics and trends analyses August 28, 2013. http://www.rita.dot.gov/bts/bts_bsee

United States Coast Guard USCG www.uscg.mil/:

- Safety & Environmental Management System (SEMS) ANPRM published in FR September 10, 2013
- Training and Manning on the US OCS ANPRM to be published in FR
- 33 CFR Subchapter “N” Update Rule Making Process (SNPRM) ongoing
- OCS Marine Casualty Reporting Rule Making Process (NPRM) ongoing

State of Alaska www.doa.alaska.gov/ogc/:

Potential Changes in Alaska

- Blowout contingency plan as part of Permits to Drill
- Relief well capability requirements. The State is looking at requiring that the operator can demonstrate ready capability to drill a relief well if needed.
- Well control certifications

- Personnel. The State is considering changing the number of persons with well control certification to 2 or 3 that must be on the rig at all times
- Equipment. The State is considering more stringent certification for all well control equipment, both new to the State and existing
- Clarification of regulations. Alaska is looking at clarifying regulations where they feel they leave too much latitude for interpretation
 - Emphasis on performance standards.
 - Guidance where needed.
- Incorporation of industry Recommended Practices (RP) and Standards. The State is considering incorporating more industry standards into regulations.
 - RP 53 → Standard 53 API RP 53 is a critical part of our regulations on well control equipment.
 - Casing and cementing standards

Norway

Petroleum Safety Authority PSA www.ptil.no/:

Focus since Deepwater Horizon

- Barriers
- Managements Role in Risk Management
- Development of Risk in Industry

International Organization for Standardization www.iso.org:

ISO Standards are currently under development in ISO Technical Committee 67 (Materials, equipment and offshore structures for petroleum, petrochemical and natural gas industries), Subcommittee 8 (Arctic Operations) (TC67 SC8). These include:

ISO/AWI 18861 Petroleum and natural gas industries -- Arctic Operations -- Working environment (Working Group 1, Norway)

ISO/AWI 18819 Petroleum and natural gas industries -- Arctic operations -- Escape, evacuation and rescue from offshore installations (Working Group 2, Russia)

ISO/AWI 18820 Petroleum and natural gas industries -- Arctic Operations -- Environmental monitoring for offshore exploration (Working Group 3, Russia)

Additional ISO TC67 SC8 Standards Working Groups that have recently formed but are not listed yet in ISO's Project plans include:

WG 4 Ice management (Canada)

WG 5 Arctic materials (Norway)

WG 6 Physical environment for arctic operations (Norway)

WG 7 Man-made islands and land extension (Netherlands)

ISO and American Petroleum Institute (API) are developing a harmonization of Arctic Structures Standard ISO 19906 and API RP2/N.

Statoil/DNV "Arctic Competence Escalator" training they have done for two years or more now, for engineers and others who will work in the Arctic. The three-day course covers Arctic regulatory systems, ecosystems, psychological stressors of working in the Arctic environment, HSE etc. -- . Leif Nesheim of DNV contact point

Appendix F – Safety Culture - Definitions, Attributes and Indicators

Definitions

There are many definitions of “safety culture”. An operator should select or develop a definition that fits their organizations culture and use it. Definitions heard at the workshops or made by Arctic States include:

“Safety culture is the product of individual and group values, attitudes, competencies and patterns of behaviour that determine the commitment to, and the style and proficiency of an organization’s health and safety programmes.” (Advisory Committee for Safety in Nuclear Installations, 1993; p. 23)

Safety Culture is *“the shared values, norms and activities used by an organization to manage risk.”* (PAME, 2013b, p. 54)

Safety Culture may be defined as *“the attitudes, values, norms and beliefs that a particular group of people shares with respect to risk and safety”* (National Energy Board (NEB) Canada – Discussion Paper on Advancing Safety in the Oil and Gas Industry – Draft Safety Culture Framework, October 2013)

Safety culture is industry’s leadership commitment and involvement in implementation of safety.
(PAME, 2013a, p. 20)

“Safety cultures are hard to create but constitute irreplaceable avenues to systems safety.” (PAME, 2013b, p. 54)

The Bureau of Safety and Environmental Enforcement - BSEE (U.S.) defines safety culture⁶⁰ as *the core values and behaviors resulting from a collective commitment by leaders and individuals to emphasize safety, over competing goals, to ensure protection of people and the environment.*

Culture: the shared values that exist within a particular organization (PAME, 2013, p. 55)

Culture determines the extent to which you live your systems (PAME, 2013b, p. 40).

Culture is what you do when no one tells you what to do (PAME, 2013b, p. 16).

The foundational publication *HSE and Culture*⁶¹ by the PSA Norway provides an excellent guide to characteristics of a sound HSE culture, sources for understanding it, factors affecting HSE culture, and management’s relationship with culture.

Attributes of a positive Safety Culture

⁶⁰ Draft Safety Culture Policy Statement

http://www.bsee.gov/uploadedFiles/BSEE/BSEE_Newsroom/BSEE_News_Briefs/BSEE_News_Briefs_2012/2012-30670_PI.pdf

⁶¹ Petroleum Safety Authority Norway, HSE and Culture .

An effective safety culture establishes the priorities for safety vs cost & schedule. (PAME, 2013b, p.17)

Attributes of a positive Safety Culture (PAME, 2013b, p. 34) include:

- Safety being a part of everything;
- Consistent leadership behaviors are evident;
- Open and honest communication prevails;
- Common goals are articulated and understood;
- People behave professionally and learning is valued;
- Standardized practices are evident and utilized;
- Consistent rules are applied to all parties;
- Standardized metrics are used for monitoring/reporting;
- Rigorous assurance processes are in place.

“Safety and influencing safety are bigger than the industry, but safety culture is not.” (PAME, 2013b, p. 55)

The various elements of the system or program are not as important as *how* they are implemented and their focus to assuring quality. Another key factor is the underpinning culture that supports the process.

Industry and regulators should foster an effective safety culture through consistent training, adherence to principles of human factors, system safety, and continued measurement through leading indicators. (NAE, 2011)

Indicators and Metrics

Assessing the effectiveness and adequacy of an operator’s safety culture requires using different indicators and metrics than for prescriptive compliance and different skills and methods for following-up than for traditional inspections or prescriptive compliance verification.

Examples of indicators and metrics for safety culture include⁶²:

- Mechanical Integrity
- Action Items Follow-up
- Management of Change
- Process Safety Training and Competency
- Operating & Maintenance
- Procedures
- Fatigue Risk Management

Methodologies include:

- Safety meeting records and document review
- Employee surveys and interviews
- Audits
- Incident investigations linked to near-miss events, and
- Behavioral observations linked to onsite visits.

Challenges

⁶² Process Safety: Leading and Lagging Metrics... You Don’t Improve What You Don’t Measure
Center for Chemical Process Safety Revised: January 2011
http://www.aiche.org/sites/default/files/docs/pages/CCPS_ProcessSafety_Lagging_2011_2-24.pdf

- Defining common indicators
- Use of different metrics
- Choosing common methodologies
- Implementing change
- Compliance verification

Incident and Near-Miss Reporting

Issues and Considerations

Incidents and near-misses are indicators used in tracking trends in systems safety performance before a systems failure and accident. Leading indicators such as preventive/corrective actions, self-inspections and identified hazards (controlled by the operator but not resulting in an incident or near-miss) can also be useful in preventing system failures. Sharing of these data and trends within the industry and between operators and regulators contributes to collective learning and can enhance a positive safety culture and increase systems safety throughout the Arctic offshore industry. The sharing of these analyses can also help identify hazards and facilitate emergency response.

Another industry that is susceptible to low frequency/high-consequence systems failure accidents is the Aviation industry. It records and makes use of near-miss incidents that, taken together, could be a model for the offshore oil and gas industry. The Aviation Safety Reporting System (ASRS) in U.S. civil aviation (based on voluntary reporting and administered by NASA) allows airline pilots and other crew members to provide near-miss information on a confidential basis. This information, in turn, is analyzed and made available to the public and across the aviation industry for educational purposes to lessen the likelihood of aviation incidents and accidents (NAE, 2011, p. 79).

Challenges

- Near-misses, incidents, hazards are not consistently defined;
- Reporting is uneven and not always required;
- Important data are often viewed or treated as proprietary;
- No comprehensive database for systems failure near-misses, incidents or hazards;
- No standardized analytical methods for determining comparable trends.

Recommended Actions/Approaches

- Define near misses, such as body-to-body incident definitions, well kicks, etc., possibly through the International Regulation Forum (IRF) as part of the Common International Incident Reporting Requirements or possibly through the International Organization for Standardization (ISO).
- Require mandatory reporting and analysis of near-miss and incident data to identify trends before an accident happens.
- Make near-miss and incident trend data and hazards data analyses publically available. And find a way around the “proprietary” nature of some information on near-misses

and incidents such as the use of anonymous or confidential reporting and release of de-identified data or analyses of data.

- Standardize analytical methods to better allow comparing of trends through coordination among regulators, industry and academia and in government regulator forums.
- Consider developing, or encouraging the development of, a Worldwide near-miss and incident database to ensure that lessons learned are communicated to all. Consider as a model, a combination of aviation's ASAP⁶³ and ASRS⁶⁴.

Measuring Occupational Health and Safety - Lagging Indicators

Issues and Considerations

Occupational performance safety is measured using 'lagging indicators' such as lost work days, recordable injuries, and accidents to detect trends that help improve performance.

Systems Safety, also called process safety, is related to complex systems or processes with many interactions and interdependencies. Systems failure accidents like the Deepwater Horizon incident are low probability-high risk events. They are rare and significant accidents that involve multiple workers or the public and often have far-reaching environmental consequences. They typically have complex causality related to unique system technology and/or design (PAME, 2013b, p 12).

A focus on occupational health and safety does not necessarily indicate a company's commitment to systems safety or the existence of a positive safety culture. It is possible, as in the case of the Deepwater Horizon incident, that operators and contractors can have a good occupational safety record while not adhering to safety of the complex systems and processes inherent in drilling in a frontier offshore area. Transocean managers were on board the Deepwater Horizon to celebrate seven years without a lost-time accident when the blowout and explosion happened. A company and their contractors who have a demonstrated positive safety culture and pay close attention to systems safety will also have a good occupational health and safety program. A company with a good occupational health and safety program, however, may not necessarily have a positive safety culture nor pay enough attention to organizational factors and systems safety. This is clearly illustrated by the fact that Transocean managers were given a Safety Bonus⁶⁵ for the year 2010 in which the Deepwater Horizon was lost--with 11 crew, 9 of whom were Transocean employees--yet it was statistically one of their safest years on record. It certainly was not one of their safest years from a systems safety perspective.

⁶³ National Aeronautics and Space Administration's Aviation Safety Action Program (ASAP)
<http://asrs.arc.nasa.gov/>

⁶⁴ the Federal Aviation Administration's Aviation Safety Reporting System (ASRS)
<http://www.faa.gov/about/initiatives/asap/>

⁶⁵ Forbes 4/02/2011 <http://www.forbes.com/sites/jeffmcmahon/2011/04/02/transocean-bonuses-deepwater-horizon-gulf-spill/>

For controlling systems safety and the risk of major accidents, relying solely on ‘lagging indicators’ is not practical since it requires too many major accidents in order to establish statistically valid trends. By using ‘leading indicators’ and near-misses, incidents and identified hazards, trends in safety risk can be detected and improvements made before major systems failure occurs.

No major offshore oil and gas industrial accidents from systems failure have occurred in the Arctic marine environment. However, Arctic offshore oil and gas activities are complex processes, involving unique system technology and design in a harsh environment and are vulnerable to systems failure. Recent assessments of industry operations in the U.S. Arctic, even after Deepwater Horizon, have shown the continued need to improve systems safety management in the industry (DOI, 2013).

Understanding risks and managing complex systems, especially in the Arctic offshore, requires a holistic approach using a combination of lagging and leading indicators that show how well the processes or systems are functioning. This requires access to all relevant data and the ability to assess complex interactions.

Challenges

- General belief that a good occupational safety record indicates good systems safety;
- Lack of knowledge or unawareness on the part of responsible personnel;
- Overconfidence based on apparent good track record to date;.
- Complacency on the part of operators (and possibly regulators!);
- Proprietary nature of some data, and sometimes difficult access to, and sharing of systems safety performance data between operators and regulators, between sectors within the company, and with the public.
- Relative complexity and expense of Systems Safety measures and techniques compared to occupational safety approach;
- The need to define, measure, analyze and share leading indicators information for systems safety and safety culture;
- The complex structure of the offshore oil and gas industry and division of technical expertise and their impacts on the ability to perform and maintain an integrated assessment of the margins of safety;
- Difficulty of convincing shareholders to spend the time, resources and funds necessary for preventing low probability events;
- Complexity of communication between operator and contractors and limited sharing of data;
- Regulator’s need for a different skill set and additional training to measure and assess the operator’s systems safety performance.

Recommended Actions/Approaches

- Regulators should ensure that operators are assessing the performance of the processes and systems that control major risk by using indicators of systems safety. This is done by using leading indicators and near-miss incidents, incidents encountered but controlled, hazards, review of company records, meetings with the operator, worker surveys, etc., to assess and improve the operator’s systems safety performance and safety culture.

- To establish and maintain systems safety integrity, regulators should promote safety by ensuring the operator demonstrates reviewable safety and vigilance initiatives in its planning and operations, from the well-design through to well-completion.
- Regulators should ensure that communication and lines-of-authority between the operator and contractors/sub-contractors are clearly established, such as by using Bridging Documents or other certified agreements or arrangements, and hold the operator responsible for their contractor's safety performance and safety culture.

Appendix G - Some regulatory coordination mechanisms⁶⁶

- Arctic Council. Since 1996. All Arctic states are members. Two Working Groups deal routinely with offshore oil and gas issues, EPPR and PAME and include national regulators in the delegations but participation varies. AMAP has an oil and gas expert group but no current plans to update the OGA. Under the Arctic Council two agreements were negotiated, the Search and Rescue Agreement (SARA, 2011) and the Oil Pollution Preparedness and Response Agreement (AOSPR, 2013) and a new Task Force to develop an Arctic Council action plan or other arrangement on oil pollution prevention is on the Canadian Chairmanship agenda for 2013-2015.]
- International Regulators Forum (IRF): Since 1996. 3 Arctic Members (US, C, N). A group of eleven regulators of health and safety in the offshore upstream oil and gas industry. It exists to drive forward improvements in health and safety in the sector through collaboration in joint programs and through sharing information.
- The International Committee on Regulatory Research and Development (ICRARD): ICRARD is focused on transferring knowledge in the area of health, safety and environment in the petroleum sector. www.icrard.org.
- North Sea Offshore Authorities Forum (NSOAF): Since 1987. Consists of representatives of authorities responsible for the supervision of offshore activities in North West Europe—there are 3 Arctic countries in membership (N, S, D-FI). Its stated aim: “Ensure and encourage continuous improvement in Health, Safety, Environmental (HSE) Care and the Welfare of offshore workers.” Holds annual meetings and has five permanent Working Groups: Training, HS&E, EU (European Union), Wells and CCS (Carbon Capture & Storage).
- Oslo-Paris Convention for protecting the marine environment of the North-East Atlantic (OSPAR): Since 1998. Includes five Arctic country members (I, S, N, F, D-G/FI) OSPAR Area 1 is the Arctic.
- EU Offshore Authorities Group (EUOAG) Since 2012. Two Arctic states are members (Denmark, Norway). A forum for the exchange of experiences and expertise both amongst national authorities and between national authorities and the Commission on all issues relating to major accident prevention and response in offshore oil and gas operations within the Union, as well as beyond its borders, where appropriate. <http://euoag.jrc.ec.europa.eu/>
- G20 Global Marine Environment Protection (GMEP) was launched and a corresponding Working Group was created in 2010. G20 Leaders mandated that the GMEP Working Group develop a Mechanism for sharing best practices to protect the marine environment, to prevent accidents related to offshore oil and gas exploration and development, as well as marine transportation, and to deal with their consequences.

⁶⁶ While there is currently no one dedicated venue that deals specifically with circum-arctic offshore operations, representatives from the Arctic regulators met in Stavanger, Norway in October 2013 and discussed the possibility of establishing a forum for regular meetings among Arctic regulators – suggesting some form of an Arctic Regulators Forum;

Appendix H - Existing Arctic Council Guidance

In recognition of the importance of management systems to the safety of operations, a tremendous amount of literature, research and guidance documents exist for developing, maintaining and improving these management systems for oil and gas and other industries (See Appendix 4; HSE Guidance for a bibliography of documents).

The Arctic Council has conducted assessments, developed Task Forces, Expert Groups, and provided guidance on various aspects of oil and gas and associated activities. The *Assessment 2007: Oil and Gas Activities in the Arctic-Effects and Potential Effects* (AMAP, 2010) (OGA), the *Arctic Offshore Oil and Gas Guidelines* (PAME, 2009a) (AOOGG), the report *Recommended Practices for Arctic Oil Spill Prevention* (EPPR, 2013a) (RP3), the *Summary Report and Recommendations on Prevention of Marine Oil Spill Pollution* (EPPR, 2013b) and the *Arctic Ocean Review Phase II report* (PAME, 2013c) (AOR), contain policy and management recommendations concerning prevention of accidents and pollution from offshore oil and gas and associated activities (Table A3). The *Arctic Search and Rescue Agreement* (SARA, 2011) and *Agreement on Cooperation on Marine Oil Pollution, Preparedness and Response in the Arctic* (AOPPR, 2013), deal with aspects of offshore oil and gas operations. Finally, there are many Arctic Council guideline documents that taken together cover all aspects of offshore oil and gas activities. These include: the *Arctic Marine Shipping Assessment*; *Arctic Region Oil Spill Response Resource and Logistic Guide*; *Arctic Response Cooperation Guidelines*; *Guidelines for Transfer of Refined Oil and Oil Products in Arctic Waters*; *A Field Guide to Oil Spill Response in Arctic Waters*; *Arctic Shoreline Clean-up Assessment Technique (SCAT) Manual*; *Environmental Risk Analysis of Arctic Activities*; *Circumpolar Map of Resources at Risk from Oil Spills in the Arctic*; and the *Arctic Guide for Emergency Prevention, Preparedness and Response*.

The *Arctic Offshore Oil and Gas Guidelines* (2009) in particular devote a considerable amount of space to the concept of, and guidance on, HSE Management Systems and related issues. Most recently, the EPPR Working Group completed the *Recommended Practices for Arctic Oil Spill Prevention* (EPPR, 2013a) (RP3) report, *Summary Report and Recommendations on Prevention of Marine Oil Spill Pollution* (EPPR, 2013b) and *Operational Guidelines for Cooperation on Marine Oil Pollution Preparedness and Response in the Arctic* (EPPR, 2013c). All contain relevant information, guidance and recommendations related to offshore oil and gas activities, including HSE Management Systems and Safety Culture, and recognize their importance in prevention of pollution.

Table A3 Arctic Council Report Oil & Gas Information, Recommendations, or Guidance

AC Product	Topic or Issue			
	Management Systems	Safety Culture	International Standards and Practices	Cooperation and Coordination
Systems Safety and Safety Culture Report (Guidance)	2.1.4 Continual improvement 2.1.6 Management System Elements 2.1.6.1 Safety System Elements common in systems failure accidents 2.1.6.1.1 Risk/Hazards Analysis 2.1.6.1.2 Management of Change 2.1.6.1.3 Training and Competence for Arctic 2.1.6.1.4 Accountability and Responsibility 2.1.6.1.5 Operating Procedures 2.1.6.1.6 Quality Assurance/Mechanical Integrity 2.1.6.1.7 Documentation and Reporting 2.1.6.1.8 Communications	2.1.7 Safety Culture 2.1.7.1 Attributes of a positive Safety Culture 2.1.7.2 Process versus Implementation 2.1.7.3 Challenges for Positive Safety Culture 2.1.7.4 Indicators and Metrics 2.1.7.5 Incident and Near-Miss Reporting	2.1.2 Prescriptive vs Performance Based Regulation 2.1.5.1 Common Arctic Standards and Practices	2.1.5 Coordination of the Regulators

AOOGG Guidance	<ul style="list-style-type: none"> • Safety and Environmental Management, p. 25 • Management Systems, p. 26 • Policy and Strategic Objectives, p. 26 • Organization, Resources and Documentation, p. 27 • Evaluation and risk management, p. 27 ○ Risk Assessment and Environmental Risk Analysis, 16 • Flow Chart depicting an environmental risk analysis scheme, p. 88 • Planning, p. 27 • Following up environmental monitoring, Audits, p 24 • Compliance Monitoring, auditing and verification, p. 28 • <i>Reporting and evaluation of compliance monitoring activities, p. 29</i> • Human Health and Safety, pp 38-39 • Training, pp 40-41 • Preparedness, p 43 • Contingency Planning, p 43 • Emergency Response Plans, pp 44-45 	Define and communicate a culture focus on safety and environmental performance and ensure implementation through a management system. p 25	<ul style="list-style-type: none"> • Standards and Practices for Environmental Monitoring, pp 23-24 • Waste Management, pp 31-34 • The use and discharge of chemicals, p 34 • Emissions to air, pp 35-36 • Design and Operations, pp 36-38 • Transportation of supplies and transportation infrastructure, pp 39-40 • Emergencies, p 43 	<ul style="list-style-type: none"> • Sustainable Development—Regional Cooperation, p 7 • Institutional Strengthening in the Regional Context, pp 9-10 • Cultural Values- Arctic States and oil and gas industry should address, p 11 • Standards and Practices for Environmental Monitoring—Industry cooperation with indigenous and local communities, p 23 • Coordination of inspections, p 29 • Preparedness-- Governments should also make appropriate arrangements that facilitate international coordination and cooperation., p 43
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	<ul style="list-style-type: none"> • Oil Spill Response Plan, pp 45-46 • Exercises and Drills, p 46 • Ice Management Plan, p 47 • Emergency Preparedness Maintenance, p 47 • Decommissioning and Site Clearance, p 49 			
RP3 Technical Report (primarily informational)	<p><i>Human Resources and Competence</i>, p 69</p> <ul style="list-style-type: none"> • Safety Culture, p 69 • Training, p 71 • Routines and Checklists, p 71 <p><i>HSE and Risk-Based Management System</i>, p 73</p> <ul style="list-style-type: none"> • HSE Definition, p 73 • Management System standards, p 74 • HSE hazards, p 74 • Barrier management, p 74 <p><i>Monitoring</i>, p 77</p> <p><i>Risk tables</i>, p 89</p>	<p>Safety Culture, p 65</p> <p><i>Human Resources and Competence</i>, p 69</p> <ul style="list-style-type: none"> • Safety Culture, p 69 	<p><i>International Standards</i>, p 23</p> <ul style="list-style-type: none"> • Barents 2020 project – Identification and comments to offshore standards, p 24 • International Organization of Standardization (ISO), p 24 • ISO 19906 – Arctic Offshore Structures, p 25 • International Maritime, pp 25-28 <p>6.11 Helsinki Commission (HELCOM), p 42</p> <p>6.12 Bonn Agreement, p 43</p> <p>6.5 OSPAR Commission, p 39</p> <p>6.6 United Nations Environment Program (UNEP), pp 39-40</p> <p>6.11 Helsinki Commission (HELCOM), pp 42-43</p> <p>6.12 Bonn Agreement, p 43</p> <p><i>Human Resources and Competence</i></p> <ul style="list-style-type: none"> • Training, p 71 • Routines and Checklists, p 71 • Management System standards, p 74 • Barrier management, p 74 <p><i>International Standards ISO 31000</i></p> <p>Risk management, p 62</p>	<p>5.2.1 Barents 2020 project – Identification and comments to offshore standards, p 24</p> <p>6.5 OSPAR Commission, p 39</p> <p>6.6 United Nations Environment Program (UNEP), pp 39-40</p> <p>6.9 Norway: preventing, acute pollution pp 41-42</p> <p>6.10 BSEE Technology Assessment & Research (TA&R) Program, p 42</p> <p>6.11 Helsinki Commission (HELCOM), pp 42-43</p> <p>6.12 Bonn Agreement, p 43</p> <p>Maritime Surveillance in the Northern Sea Basins pilot project, p 43</p> <p>Create framework conditions for good collaboration in the operator–supplier hierarchy, p 50</p> <p>circumpolar cooperation regulatory forum, p 80</p>

RP3 Summary Recommendations			Standards for Arctic oil and gas activities, p 10	Facilitate oil spill prevention research and regulatory cooperation, p 11
AOR (Recommendations)			Recommendation 14: Support ISO and other processes to develop standards relevant to Arctic oil and gas operations.	Recommendation 15: Based on AOOGG and RP3 move toward circumpolar policy harmonization in discrete sectors. Recommendation 16: Promote interactions with the appropriate international treaty bodies on offshore oil and gas issues. Recommendation 17: Industry and regulator involvement in AC initiatives on offshore oil and gas by convening an Arctic-specific oil and gas dialog for industry and contractor groups.
OGA Ch7 and AOG Summary Report (Recommendations)	<p>7.3.2 Point sources of pollution and concentration gradients</p> <p>R7. Better reporting and monitoring of point sources of operational discharges and emissions.</p> <p><i>Management of Arctic Oil and Gas Development-Laws and Regulations.</i></p> <p>AOG p vii</p> <ul style="list-style-type: none"> • Enact, review, strengthen and enforce • Clear and flexible management systems and regulations, reviewed regularly for effectiveness, adequacy, consistency. • Improve compliance monitoring and implementation of regulations. • Assess industry's degree of compliance 		<p>7.3.1. Use of best practices</p> <p>R2 Require use of best available technologies and practices including consultation, closed-loop drilling, transportation, seasonal restrictions, and monitoring</p> <p>R3. Use clear and flexible regulations, compliance monitoring, coordination, adaptive management.</p> <p>7.3.1. Pollution prevention</p> <p>R4. Zero discharge of harmful substances, end or reduce flaring, use less harmful materials and chemicals, conserve, recycle and reuse waste.</p> <p>7.3.2 Point sources of pollution and concentration gradients</p> <p>R7. Better reporting and monitoring of point sources of operational discharges and emissions.</p> <p>7.3.4. Coordination of research</p> <p>R39 Coordination of research to provide possible common methodologies, species, and publication guidelines. Use agreed</p>	<p>7.3.1 Use of best practices</p> <p>R3 Establish a mechanism to share experiences, coordinate and cooperate on methods of risk and impact assessments and management of the oil and gas industry.</p> <p>7.3.4. Research to improve technology</p> <p>R25 Cooperate on research to improve oil and gas exploration and development technology.</p> <p>7.3.4. Coordination of research</p> <p>R39 Coordination of research to provide possible common methodologies, species, and publication guidelines.</p> <p><i>Managing Oil and Gas Development Technology and practices</i>, AOG p. viii</p> <p>Improve international coordination of oil transport information.</p> <p><i>Managing Oil and Gas Development-Spill Prevention and Response</i> AOG, p viii</p> <p>Cooperation and emergency communications between operators and local, regional, national and international authorities on routes and schedules of</p>

	<p>with applicable domestic regulations and monitoring programs.</p> <ul style="list-style-type: none"> Continuously improve guidelines and the legal framework for oil and gas activities and oil spill response. <p><i>Managing Oil and Gas Development-Spill Prevention and Response</i> AOG, p viii</p> <ul style="list-style-type: none"> Actions should be evaluated and applied to reduce risks of spills. High level of emergency preparedness including continued review of contingency plans, training of crews to operate and maintain equipment, and conducting response drills. 		<p>statistically-based standards of analytical quality.</p> <p><i>Management of Arctic Oil and Gas Development-Laws and Regulations</i> AOG p vii</p> <p>Require use of best industry and international standards in laws and regulations.</p> <p><i>Managing Oil and Gas Development- Technology and practices</i> , AOG p. viii</p> <p>International standards and national legislation for ships engaged in oil transportation in seas with potential for ice problems should be reviewed for adequacy and strengthened as appropriate.</p>	<p>transport and response capabilities need to be established and maintained.</p>
SARA Agreement			<p>Article 7 Conduct of Aeronautical and Maritime Search and Rescue Operations</p>	<p>Article 7 Conduct of Aeronautical and Maritime Search and Rescue Operations</p> <p>Article 8 Request to Enter the Territory of a Party for Purposes of Search and Rescue Operations</p> <p>Article 9 Cooperation Among the Parties</p> <p>Article 10 Meetings of the Parties</p> <p>Article 11 Joint Review of Search and Rescue Operations</p>
AOPPR Agreement			<p>1982 United Nations Convention on the Law of the Sea, the 1990 International Convention on Oil Pollution Preparedness, Response</p>	<p>Article 1 Objective of this Agreement</p> <p>Article 4 Systems for Oil Pollution Preparedness and Response</p> <p>Article 6 Notification</p>

			<p>and Co-operation, the 1969 International Convention Relating to Intervention on the High Seas in Cases of Oil Pollution Casualties, and the “polluter pays” principle as a general principle to be applied. International Maritime Organization</p> <p>Article 4 Systems for Oil Pollution Preparedness and Response</p> <p>Article 5 Authorities and Contact Points</p> <p>Article 16 Relationship with Other International Agreements</p>	<p>Article 7 Monitoring</p> <p>Article 8 Requests for Assistance and Coordination and Cooperation in Response Operations</p> <p>Article 9 Movement and Removal of Resources across Borders</p> <p>Article 10 Reimbursement of Costs of Assistance</p> <p>Article 11 Joint Review of Oil Pollution Incident Response Operations</p> <p>Article 12 Cooperation and Exchange of Information</p> <p>Article 13 Joint Exercises and Training</p> <p>Article 14 Meetings of the Parties</p>
<p>AOPPR Agreement</p> <p>Annex IV</p> <p>Operational Guidelines</p>				<p>Notification p. 14</p> <p>Assistance pp. 14-18</p> <p>Movement and Removal of Resources across Borders pp.18-21</p> <p>Response Operations in Areas Beyond National Jurisdiction pp. 8-22</p> <p>Command and Control 22-23</p> <p>Facilitation of Situational Awareness and A Common Operating Picture pp.23-24</p> <p>Joint Review of Oil Pollution Incident Response Operations pp.24-25</p> <p>Reimbursement of Costs of Assistance p. 25</p> <p>Joint Exercises and Training p. 25</p> <p>Administrative Provisions pp. 25-26</p>