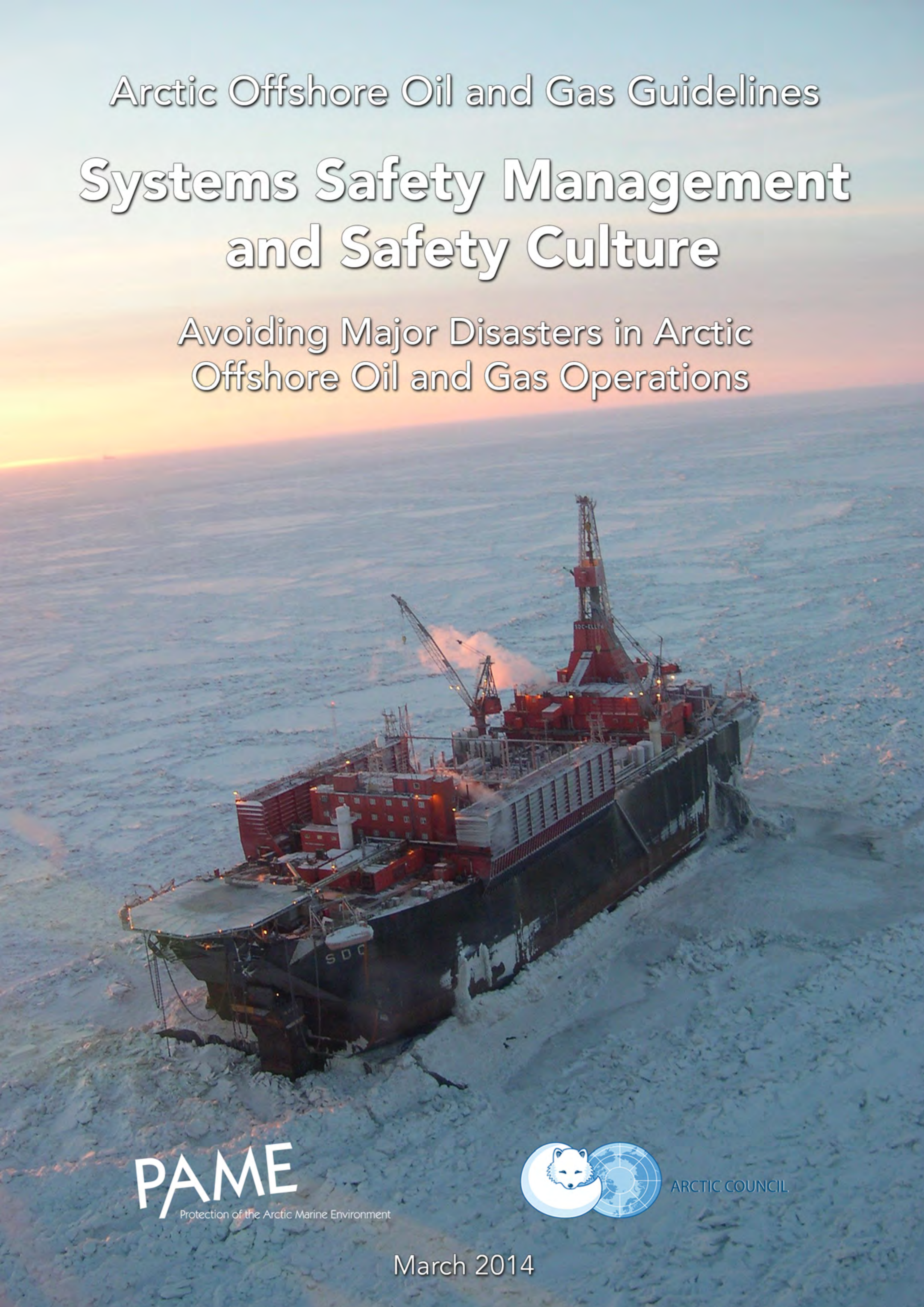
Arctic Offshore Oil and Gas Guidelines

Systems Safety Management and Safety Culture

Avoiding Major Disasters in Arctic Offshore Oil and Gas Operations



PAME
Protection of the Arctic Marine Environment

ARCTIC COUNCIL

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

Photo credit; Randy Howell, U.S. Bureau of Safety and Environmental Enforcement
Drilling vessel operating the U.S. Beaufort Sea 2003.

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Foreword

The Arctic Offshore Oil and Gas Guidelines (AOOGG): Systems Safety Management 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. In addition, input was received from 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 also received from many individuals and organizations including a wide range of representatives from Arctic governments, non-governmental organizations, industry, indigenous people, and the scientific community.

This Guidance document has been circulated widely to Arctic States, 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.

The project lead would like to thank all PAME countries, other Arctic Council working groups and Permanent Participants to the Arctic Council, experts and other stakeholders for their support and contributions to this work.

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
NAE	U.S. National Academy of Engineering
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, 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 negative 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 U.S. history. The economic, environmental and social impacts of this disaster are still being felt by many communities around the Gulf. If such an incident were to occur in the Arctic offshore, the outcome could be much worse.

Arctic States have an important role to play in both regulating and influencing the safety of oil and gas operations in the Arctic. Recognizing this, the Protection of the Arctic Marine Environment (PAME) Working Group (under the auspices of the Arctic Council) undertook to prepare 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 investigations and recommendations from the Deepwater Horizon accident as well as numerous other investigations and hearings. The PAME Working Group also benefited from discussions and recommendations from two specific workshops involving international experts from governments, various industries, academia, indigenous peoples organizations, and other Arctic stakeholders.

The first workshop was on Health, Safety and Environment (HSE) Management Systems held in Keflavik, Iceland from June 10-12, 2012. It focused on health, safety and environmental requirements, recent changes in regulatory regimes and the Arctic-relevant lessons to be learned from the Deepwater Horizon accident. 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 5 and in Appendix F. The current guide includes a separate section on regulatory regimes and standards around the Arctic (Section 4). Further information is included 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 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 over-arching issues of Coordination among Regulators and Safety Culture (examined at the beginning of Section 5), the areas recommended for more focused safety guidance are limited to the following nine (9) categories:

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

Section 5 of the current guide elaborates on each of these safety system elements. It outlines some key issues and challenges, as well as some recommended actions or approaches that regulators should pursue, for improving system safety when regulating or influencing the safety of offshore 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 safer and more robust Arctic offshore oil and gas systems safety management.

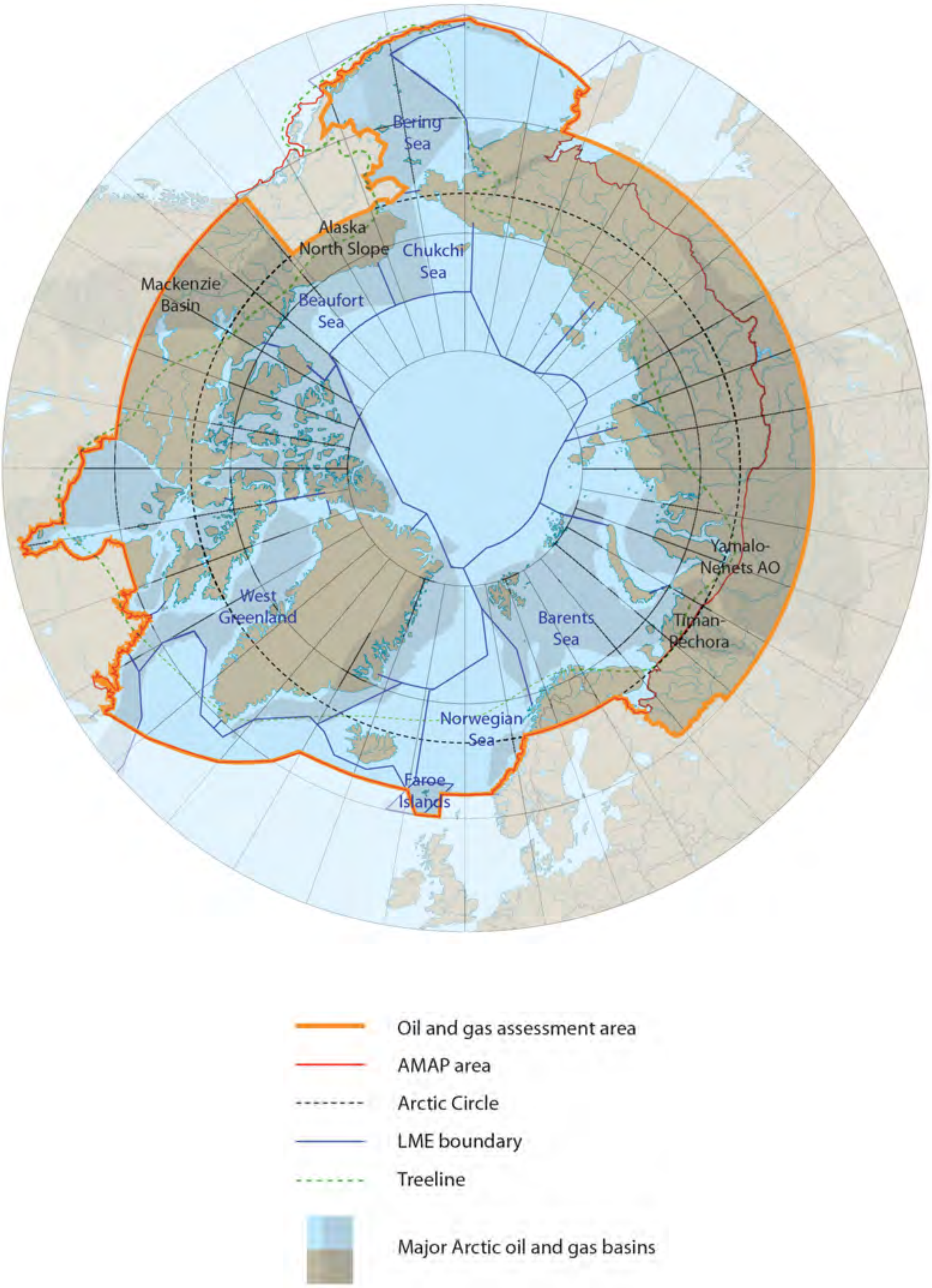

Figure 1. Defined areas within the Arctic[1] (after Figure 1.1 from the Assessment 2007: Oil and Gas Activities in the Arctic: Effects and Potential Effects, Arctic Monitoring and Assessment Program, 2010)

[1] Neither PAME nor the full Arctic Council has established a single geographic definition of the Arctic. This is left for Arctic states to determine with reference to Annex A of the 2009 Arctic Offshore oil and Gas Guidelines (2009) on definition of the Arctic.

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

1. Introduction

1.1 Background

The Arctic Council[2] is a high level intergovernmental forum to provide a means for promoting cooperation, coordination and interaction among the Arctic States, with the involvement of the Arctic Indigenous communities and other Arctic inhabitants on common Arctic issues, in particular issues of sustainable development and environmental protection in the Arctic. Offshore oil and gas activities have been a focus of the Council as it continues to promote sustainable development and environmental protection in the Arctic.

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 possible negative impacts such an increase in these activities could have on the Arctic marine environment and the way of life of indigenous people and local communities. Recognizing this, the Arctic Ministers[3] tasked the PAME Working Group in 1996 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.

The PAME Working Group developed the current guide in response to further significant changes observed in industry, regulatory regimes, rules, as well as the public's perception and concern regarding safety of offshore oil and gas activities since the AOOGG 2009 update. This Guidance document is intended to enhance and supplement the 2009 AOOGG by focusing on providing tools and approaches for reducing the threat of catastrophic effects of major offshore oil and gas related accidents. Fortunately, these major 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 Australia[4] and the Macondo well[5] in the Gulf of Mexico, have identified particular failures in the

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

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

[4] 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;

[5] 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 U.S. history.

Operator's safety management systems as root causes of the specific problems that led to these blowouts. These included both human and organizational factors, as well as a lack of "safety culture," within the operating organizations.

The title of the original project proposal as approved by the Arctic 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,[6]" referred to as the "HSE" project. At the same time as they approved the current project, the Arctic Ministers also directed the Emergency Prevention, Preparedness, and Response (EPPR) Working Group to develop best practices/recommendations for the prevention of oil pollution[7]. As the current project proceeded, the issues became more focused. This Guidance document deals only with "systems safety," or sometimes called "process safety," not occupational health or safety. 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 report Oil and Gas Activities in the Arctic: Effects and Potential Effects (OGA[8]) (AMAP, 2010). 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, broadening the scope from "drilling activities" to the full range of operations, and relying on EPPR to report on guidance for best operating practices.

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.

1.2 Scope & Purpose

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. This Guidance document should help 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

[6] Protection of the Arctic Marine Environment Working Group Work Plan 2011-2013, www.pame.is

[7] The Emergency Prevention, Preparedness and Response (EPPR) Working Group subsequently published the *Recommended Practices for Arctic Oil Spill Prevention* (EPPR, 2013a http://www.arctic-council.org/eppr/wp-content/uploads/2012/05/DNV-Report_AC_RP3_Scoping-Workshop_Rev2_FINAL.pdf)

[8] AMAP, 2010--Assessment 2007: Oil and Gas Activities in the Arctic—Effects and Potential Effects (OGA), Arctic Monitoring and Assessment Program Working Group (www.amap.no/oga)

in the industry while operating in the Arctic offshore.

The report examines the importance of "safety culture" and "regulatory coordination" early in Section 5 and highlights nine (9) categories of safety management. These nine elements include:

- **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**
- **Communications**

Treatment of each of these topics or elements (examined in detail in Section 5) 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.

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 pertinent regulations from Russia, Iceland and Faroe Islands were not available for this table. The role of "regulations and standards" is discussed in Section 4.

This guide, 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. It 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 elements of systems safety that form part of the complex offshore operations in the Arctic. Better understanding of risk management and use of targeted guidance recommendations (embraced and implemented) should help prevent major disasters that could be so devastating in the sensitive Arctic marine environment.

The information, references and guidance contained in this document will be useful to both management and safety practitioners. It will serve especially to clarify the perspectives that must be taken by regulators in overseeing and promoting improvement of the management of systems safety and performance of oil and gas operations in the Arctic offshore.

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. 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 clearly understood and 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 offshore oil and gas exploration and production in the Arctic.

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 oil and gas industry it regulates. The findings and guidance of this document should be 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.

2. The Challenging and Diverse Arctic Operating Environment

Arctic offshore operations are complex and often face extremely challenging conditions. These may include sub-zero temperatures, sea ice and icing, remoteness, communication interruptions 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 in the area. Arctic operational conditions can also vary significantly by season and region. As a result, 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 and implementation plans.

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 and longer lasting than the 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 wells could be more problematic 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 severe, more extensive and/or longer lasting because of the fragile and sensitive nature of the environment and persistence of oil in cold temperatures; and

- LOCAL COMMUNITIES could suffer substantial harm as serious socioeconomic and cultural consequences of disasters would likely impact local communities and livelihoods that depend on the Arctic Ocean for subsistence foods, cultural and traditional ways of life.

The Arctic is a frontier area where some regions are characterized by specific physical environmental conditions and where technology and practices are pushing the limits of experience. This type of situation requires constantly evaluating and assessing the risk of system failures. Wherever individual human error/misjudgment or organizational management lapses can occur, the potential for system failure exists. Safety management systems, therefore, must be resilient enough to avoid or mitigate the consequences of individual human or organizational breakdowns.

Figure 2. Concrete Island Drilling Structure in the U.S. Beaufort Sea. Photo: U.S. Bureau of Safety and Environmental Enforcement, 2000.

3. Lessons Learned from International Experience

3.1 Lessons Learned, Lessons Forgotten

Learning from major events, such as the Piper Alpha[9] or the Deepwater Horizon accidents, tends to peak soon after the event and then starts to fade[10]. Lessons are often learned through personal experience and kept alive by memories and by teaching others[11]. When memories fade and personal experience is lost, lessons tend to be diluted, not passed on, or forgotten entirely. Few organized courses teach upcoming generations about systems safety and lessons learned from major accidents[12]. Such knowledge is all too 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 is, therefore, necessary to draw from experience and lessons learned from major accidents in non-Arctic offshore areas as well as from other sectors, such as aviation, nuclear, chemical, military, and others. These can be instructive for low incidence/severe consequence analyses. 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. These might include, for example, incidents and near-misses, results of audits, worker questionnaires and surveys, records of safety meetings, and other safety tracking documents.

> *"Safety and environmental protection are not proprietary"*
>
> *(PC, 2011, p. 217).*

Collective learning from sharing incident and near-miss data and analyses between operators and regulators is necessary to ensure that lessons learned are applied <u>before</u> 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 greater transparency and strengthen industry and regulator accountability.

The lessons learned 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 should always be aware of the importance of not repeating the human and organizational mistakes of these systems failure accidents.

[9] 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

[10] PAME, 2013b, Report—Findings and Recommendations of the Safety Culture Workshop, Protection of the Arctic Marine Environment Working Group, p.15 http://www.pame.is/index.php/projects/offshore-oil-and-gas/safety-culture-workshop-2012

[11] *Ibid:* p. 27

[12] *Ibid:* p. 19

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

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

A study of causes of eight major industrial accidents, done by Det Norske Veritas (DNV) for the National Energy Board Canada's Arctic Drilling Review, showed failure in four main safety management systems elements[13] :

- ***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:
  - lack of communications, documentation and document control;
  - poor operational control;
  - inadequate management of change; and
  - 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.

[13] PAME 2013a. Report – Findings and Recommendations of the Health, Safety and Environmental Management Systems Workshop, p. 15, http://www.pame.is/index.php/projects/offshore-oil-and-gas/hse-workshop-in-iceland-2012

In a Bureau of Safety and Environmental Enforcement-BSEE (U.S.) analysis of 1000 accident investigations in the U.S. Outer Continental Shelf[14], 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:

- 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, Shell launched a long anticipated drilling campaign in the Chukchi and Beaufort seas in the U.S. Arctic. Although, operations during the restricted[15] 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 Shell's summer Arctic drilling operations in late 2012, a U.S. Coast Guard inspection found numerous deficiencies including that no audit records were available and crewmembers were not familiar with the safety management system[16]. 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 many failures or deficiencies in elements of their safety management system[17]. These related to documentation, management of change, integrated risk assessment, contractor management and mechanical integrity. In addition, it was observed that there was limited attention paid to integrated planning for 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 causes[18] :

- 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); and
- Work pressure/cost (identified 4 times).

[14] PAME Report – Findings and Recommendations of the Health, Safety and Environmental Management Systems Workshop – 2013a, p. 21, http://www.pame.is/index.php/projects/offshore-oil-and-gas/hse-workshop-in-iceland-2012

[15] DOI, 2013 – The Department of Interior Assessment of Shell's 2012 Arctic Drilling Program, 2013, http://www.doi.gov/news/pressreleases/upload/Shell-report-3-8-13-Final.pdf

[16] 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-releases

[17] The Department of Interior (DOI) Assessment of Shell's 2012 Arctic Drilling Program, 2013, p. 1

[18] PAME Report – Findings and Recommendations of the Health, Safety and Environmental Management Systems Workshop – 2013a, p. 14 and PAME Report – Findings and Recommendations of the Safety Culture Workshop, 2013, p. 44

3.3 Outcomes of Relevant Workshop Discussions

Two offshore oil and gas workshops were held in support of the project to develop this guide. 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.

These workshops provided many recommendations--including that this guide 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 the following elements were selected as a sub-set for more guidance in the Arctic context for this document (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
- Communications

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

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 provided in this document. 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.

4. Regulatory Regimes and Standards

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, largely reflecting their own operating conditions, national culture and social, political, and economic circumstances.

Table A1 in Appendix A summarizes the regulatory regimes from Norway, Canada, Greenland and the United States. For consistency with this guide, the table makes use of the same nine (9) safety system categories selected for more specific guidance/recommendations in Section 5. 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 the PAME AOOGG 2009 (www.pame.is).

4.1 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 range 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 absent[19] and safety management systems designed to reduce the risk of failure during these operations were voluntary and ineffective.

Given 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 regulation[20] 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 came to the same conclusion[21].

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 **–** whereby the operator assumes no liability by claiming they followed the rules or their safety plan was approved. This can have the effect of placing responsibility for safety and environmental protection back on the regulator; and
- Challenges exist for the regulator in implementing safety 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; and
  - More guidance and education required from the regulator.

[19] NAE, 2011--*Macondo Well–Deepwater Horizon Blowout: Lessons for Improving Offshore Drilling Safety Offshore,* National Academy of Engineering, December 2011, p. 84, http://www.nae.edu/Activities/20676/deepwater-horizon-analysis.aspx

[20] PAME, 2009a--Arctic Offshore Oil and Gas Guidelines (AOOGG), Protection of the Arctic Marine Environment Working Group, p. 25, http://www.pame.is/images/03_Projects/Offshore_Oil_and_Gas/Offshore_Oil_and_Gas/Arctic-Guidelines-2009-13th-Mar2009.pdf

[21] EPPR, 2013a—Report: Recommended Practices for Arctic Oil Spill Prevention (RP3), Emergency Preparedness, Prevention and Response Working Group, p. 7, http://www.arctic-council.org/eppr/wp-content/uploads/2012/05/DNV-Report_AC_RP3_Scoping-Workshop_Rev2_FINAL.pdf

Recommended Actions/Approaches

- Although prescriptive regulations may be appropriate and effective for some elements of the safety system, Arctic countries should consider expanding, where appropriate, more performance-based regulatory approaches.

- 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.

4.2 Arctic Standards and Best Practices

Issues and Considerations

While there are some international and/or industry standards that may be applicable generally to operations in the Arctic, there are few standards which apply specifically to Arctic operations.

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 2020[22] project. This latter project saw some 130 offshore standards adopted or modified for common use in the Barents Sea. Efforts are also underway in ISO for developing Arctic offshore oil and gas standards based on the results of the Barents 2020 program (see Appendix D for further ISO Standards initiatives).

Challenges

- No single authority or organization exists to comprehensively or systematically address Arctic-specific standards;
- Personnel, financial and time constraints make it difficult to coordinate standards initiatives across the Arctic so 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; and
- There may be overlap in the different standards developed by governments, companies and organizations and how these apply to the various operations or processes.

Recommended Actions/Approaches

- Industry and regulators should work together to initiate, implement, monitor, and continuously improve standards and best practices for 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.

[22] Barents 2020 Final Report 2009, Assessment of international standards for safe exploration, production and transportation of oil and gas in the Barents Sea-- Harmonisation of Health, Safety, and Environmental Protection Standards for The Barents Sea http://www.dnvusa.com/Binaries/Barents_2020_report_%20phase_3_tcm153-519577.pdf

- 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.

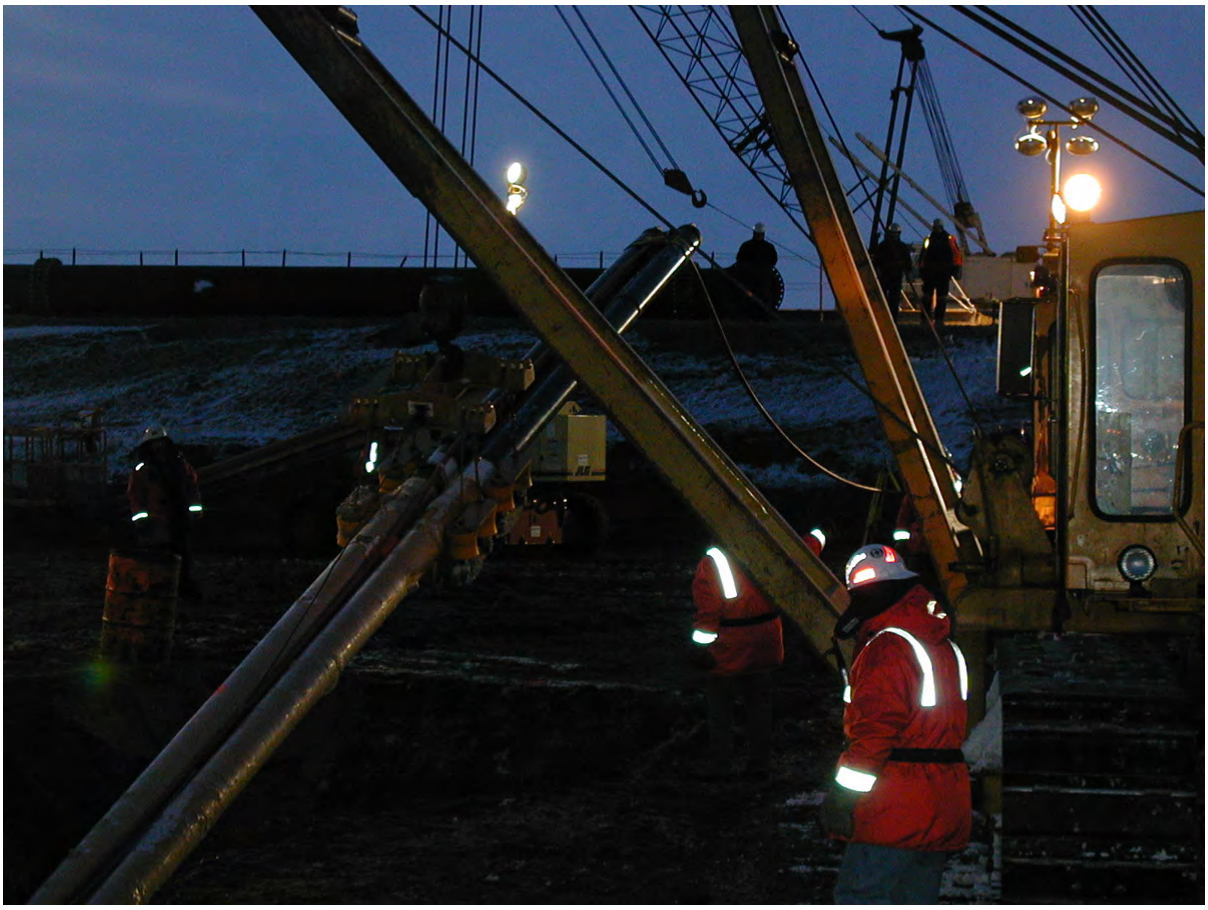

Figure 3. Laying of offshore pipelines in the Beaufort Sea, Photo: U.S. Bureau of Safety and Environmental Enforcement, 2000.

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

5.1 Coordination Among Regulators

Whether seeking to pursue continuous improvement initiatives, better and more focused training or more effective communications, 'coordination' is another vital tool in the regulator's toolbox.

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 AOR[23]. 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.

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 remedial measures that work can only serve to refine and improve the ability for regulators to constantly raise the bar and enhance safety (or minimize risk of failures) in the Arctic offshore 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

[23] OGA, 2010-- AMAP Assessment 2007: Oil and Gas Activities in the Arctic—Effects and Potential Effects (OGA), Arctic Monitoring and Assessment Program Working Group, www.amap.no/oga; AOOGG--Arctic Offshore Oil and Gas Guidelines, Protection of the Arctic Marine Environment Working Group www.pame.is; RP3--Summary Report and Recommendations for Prevention of Marine Oil Pollution, Emergency Preparedness, Prevention and Response Working Group, 2013, www.arctic-council.org; AOR-- Arctic Ocean Review Phase II Report (AOR), Protection of the Arctic Marine Environment Working Group, www.pame.is.

The following nine (9) elements are highlighted for more specific guidance in sub-sections *5.3 to 5.11.*

- **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**
- **Communications**

But before discussing each of these elements in turn, the following sub-section *5.2* examines more closely the role and importance that 'safety culture' plays in providing the overall framework and foundation for safety actions and ongoing vigilance.

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)

5.2 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 Mexico[24]. 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 culture[25]. 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, and equipment repairs were jury-rigged—all symptoms 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

[24] NAE, 2011--Macondo Well–Deepwater Horizon Blowout: Lessons for Improving Offshore Drilling Safety Offshore, National Academy of Engineering, December 2011; PC, 2011-- National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling Report to the President, www.oilspillcommission.gov; PAME 2013a—Report: Findings and Recommendations of the Health Safety and Environmental Management Systems Workshop, Protection of the Arctic Marine Environment Working Group p. 6; and PAME 2013b--Report: Findings and Recommendations of the Safety Culture Workshop, Protection of the Arctic Marine Environment Working Group, p. 5

[25] DOI, 2013--The Department of Interior Assessment of Shell's 2012 Arctic Drilling Program, 2013

minimizing risk and maximizing safety. This 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 should be 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 and improves) a positive safety culture[26].

Safety culture must be defined, understood, and clearly communicated by operators to everyone, including contractors and regulators. This includes a process to put in place a consistent policy for safety culture that[27] :

- says the organization has a safety culture and defines it;
- has leadership commitment 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)

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 and a process for implementing and improving safety culture. In 2012, a strong focus on safety culture was also evident in Shell's HSE Management system[28]. However in both cases, it would appear these were not fully and properly implemented.

[26] PAME, 2013a—Report: Findings and Recommendations of the Health Safety and Environmental Management Systems Workshop, Protection of the Arctic Marine Environment Working Group, p. 14; and PAME 2013b--Report: Findings and Recommendations of the Safety Culture Workshop, Protection of the Arctic Marine Environment Working Group, pp. 6, 15, 22, and 45

[27] PAME, 2013b--Report: Findings and Recommendations of the Safety Culture Workshop, Protection of the Arctic Marine Environment Working Group, p. 53

[28] PAME, 2013b--Report: Findings and Recommendations of the Safety Culture Workshop, Protection of the Arctic Marine Environment Working Group, p. 30

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).

"SNAFU - Situation Normal All Fouled Up"

Challenges

- ***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. 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.

"Can't happen here, Can't happen to me, Can't happen again"

- ***Complacency*** - Complacency is an all too common risk factor for low probability-high consequence accidents. Safe work records and no-loss work days do not necessarily reflect a positive safety culture nor serve as reliable indicators of systems safety. Over-reliance on 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 safety vigilance.

"…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)

No Cowboys

- ***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 effective[29]. But with the prevalent "can do" attitude, lessons were learned and the technologies and practices were modified to

[29] Arctic Oil and Gas 2007, Arctic Monitoring and Assessment Program, 2007, pp. 22-23. www.amap.no/oga

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.

"Time is money!"

- ***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 well[30], even in shallow water and total costs can be in the billions of U.S. dollars.[31] These costs are not unknown to those involved in planning, fabricating and working to complete the program. Demands to complete the work on time and within budget places added stress on the management and drilling team and can easily be exacerbated by possible shorter drilling seasons and harsher operating environment compared to other offshore areas. "Can Do" attitudes from the past must be replaced with more risk averse approaches ("Can do safely, or won't do") where system safety performance is clearly paramount.

Recommended Actions/Approaches

- Regulators must define and communicate expectations regarding positive safety culture and require operators to establish, implement, and improve their safety culture.

- 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.

- 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 document).

[30] AMAP, 2010--AMAP Assessment 2007: Oil and Gas Activities in the Arctic—Effects and Potential Effects (OGA), Arctic Monitoring and Assessment Program Working Group p.2_12

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

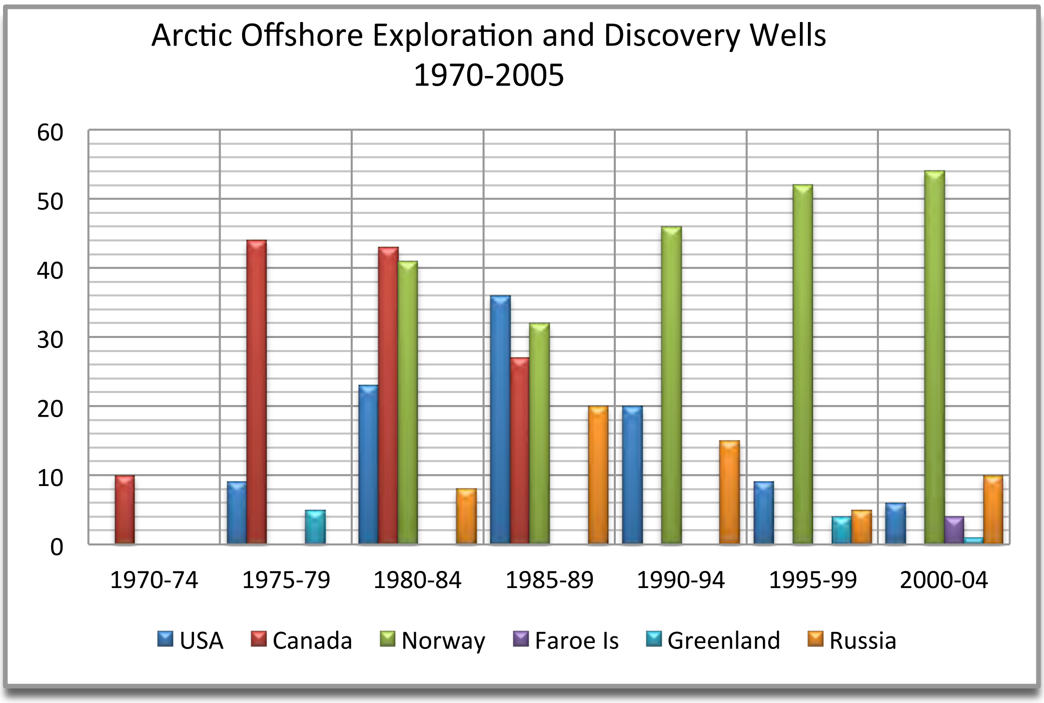

Figure 4. Number of offshore Arctic exploration and discovery wells from 1970 to 2005 in 5-year increments. Modified from OGA Chapter 2 Figure 2.2c (OGA, 2010). Arctic includes offshore areas for the USA in the Bering, Chukchi and Beaufort seas, including State of Alaska waters; for Norway in the Norwegian and Barents Sea; for Canada in the Eastern Arctic, Hudson Platform, Labrador Shelf, and Makenzie/Beaufort Sea; and for Greenland and Faroe Islands, all offshore areas. A few Arctic offshore wells have been drilled in Russia, USA, Greenland, and Norway since 2005.

- Require operator to designate a responsible and accountable person (preferably the CEO) for their safety culture.
- Operators and regulators should avoid becoming complacent by over-relying on occupational safety records.
- 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.
- Regulators should undertake thorough and frequent field inspections.
- 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 penalties (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; and
- Enact `whistle-blower` provisions and personnel protection guarantees.

- Operators and regulators should always experience "Chronic Unease" to avoid complacency.

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)

5.3 Continuous Improvement

Issues and Considerations

To prevent a major accident from occurring during offshore oil and gas operations in the Arctic, industry must implement and continuously improve their safety management systems by systematically monitoring, assessing, and managing risk.

For industry, 'continuous improvement' in safety management systems should cut across the entire operation and 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. All safety and pollution incidents, as well as near-misses, should be reported, analyzed, and shared throughout the industry in order to identify trends in safety performance and safety culture that may reveal potential for systems failure. Sharing trend information with the public helps build public trust and can 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 may not be analyzed in a way that helps identify opportunities for improvement;
- Data collected may vary considerably and lack of industry standards may make it difficult to assess and compare performance;
- Operator may not have an effective system to improve performance based on their performance assessments; and
- Operator may not always implement their safety management systems effectively.

Recommended Actions/Approaches

- Regulators must continuously evaluate and seek to improve their supervision by reviewing the regulatory system for clarity and effectiveness.

- 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; and
  - meaningful enforcement actions.

- Continuous improvement in offshore performance should be seen as a collaborative activity requiring cooperation and actions by both industry and regulators.

What is different about operations in the Arctic and what increase in risk is associated with those differences? **Δ Arctic = ↑ Risk?**

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

- ↑ Probability
- ↑ Risk

↑ 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

↑ 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)

5.4 Risk Assessment/Hazard Identification

Issues and Considerations

In the Arctic, there are many hazards to human health, safety, and operational integrity not encountered elsewhere. 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. In order to properly and fully assess operational risk, the operator should also take into account local and Traditional Knowledge (TK) on weather and sea ice implications for marine transportation and ice roads. The operator should also consider local 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.

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. The operator must adopt a formal process to identify and address the risks and implement it throughout the whole company. This process may include training, communication, clearly designating responsibilities and demonstrating commitment to a positive safety culture.

Reporting of "near-miss" data becomes particularly important given the lack of experience and history of operations in the offshore Arctic. All incidents and near-misses must be reported in any ongoing hazard identification and risk assessment program. Such reporting and analyses can help others better understand and ultimately act to reduce the risks for potential incidents.

> A safety management and safety culture survey on the Transocean Deepwater Horizon a few weeks before the accident found that 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."*
>
> PC, 2011

Risk management is an integral part of an operator's safety management system. There are numerous ways of illustrating and tackling risk assessment. The Environmental Risk Flow Diagram example contained in the AOOGG 2009 (p. 88 Annex F) represents one such approach for evaluating risk. Other approaches may employ risk diagrams such as so-called 'Bow-Tie Risk' diagrams (see Figure 2 below). These can help illustrate multiple pathways for possible failures, associated barriers/controls and ultimate consequences that may occur.

Regardless of the risk analysis method adopted, it is crucial that some structured approach be taken to identify, assess, prioritize and mitigate the potential hazards.

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 broad range of technical expertise can adversely affect the ability to perform and maintain margins of safety;

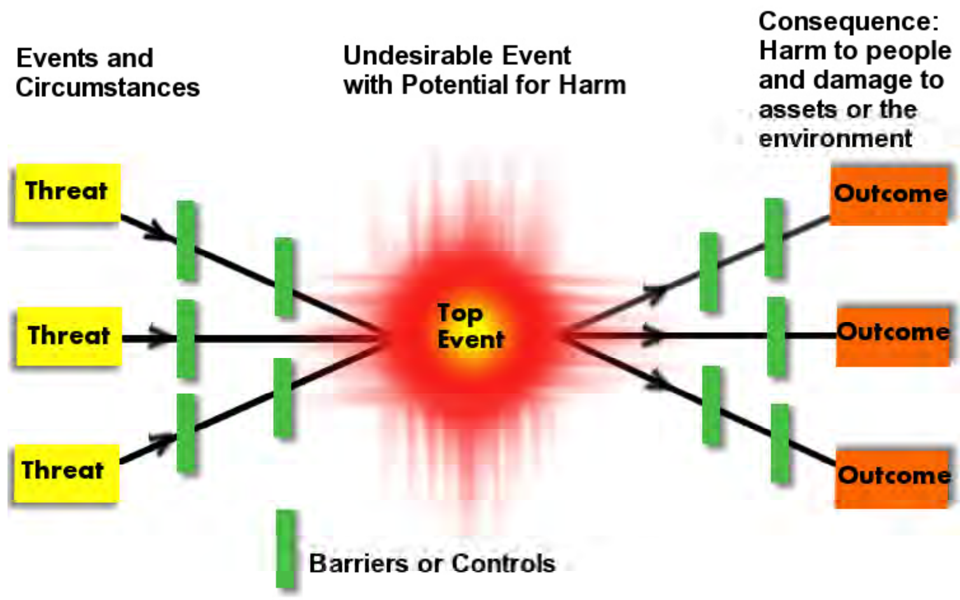

Figure 5. Example of a Bow-Tie Risk Diagram

- 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;
- Inter-related (and sometimes conflicting) decisions and actions taken across units, departments, and contractors can cumulatively raise the level of total risk for the operation beyond acceptable limits; and
- 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; and
    - 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 regulations, standards and industry guidance.
- Require the operator to assess risks associated with cold environment technologies so that safety performance can be improved <u>before</u> breakdowns or accidents happen.

- 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 safety 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 safety 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;
  - ensuring 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; and
  - 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. Regulators should have the operator:

- define the safety envelope;
- clearly establish proven practice;
- assess uncertainties and adjust levels of safety margins; and
- factor in the differences in exploration and production operations and geology and Arctic ice type/conditions.

> *"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)

5.5 Management of Change

Issues and Considerations

Management of change is vitally important in complex and varying offshore operations. Management and crew aboard the Deepwater Horizon were found to have neither adequate training nor sufficient understanding of the consequences of operational changes[32]. 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 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 in response to extreme and/or changing Arctic environmental conditions;
- Improving safety management systems through better training, more robust risk assessments, enhanced documentation and more effective communications;
- Increasing awareness and understanding of exactly what constitutes 'change';
- Ensuring resiliency/flexibility is built into the safety management systems; and
- Reversing the poor safety culture that may exist.

Recommended Actions/Approaches

➢ Regulators and operators must constantly seek to improve their approach to the 'Management of Change' through hazard

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

identification, risk analysis/assessment and 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, such assessments should fully consider relevant Arctic multipliers.

5.6 Training and Competence for the Arctic

Issues and Considerations

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. 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.

Insufficient training and lack of training were identified as contributing factors in the Deepwater Horizon accident[33] and have been found to be a common factor in many major industrial accidents.[34]

Specialized mechanical and human factor training for cold weather operations, firefighting, emergency and environmental response and cultural sensitivity is essential for personnel working in the Arctic.

Using a performance-based regulatory regime requires regulators to have broader supervisory skills and perspectives than a typical prescriptive regime. Instead of simply inspecting facilities and equipment, checking boxes on compliance forms, and issuing citations, regulators, within a performance-based regime, must be more broadly trained and possess wider skill sets in order to effectively monitor and enforce safety and environmental protection.

Challenges

- Qualified and Arctic-experienced personnel may be difficult to attract and recruit;
- It may be difficult to find and hire operating 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; and
- Recruiting and retaining a trained and competent regulatory workforce is difficult.

[33] NAE, 2011–Macondo Well-Deepwater Horizon Blowout: Lessons for Improving Drilling Safety Offshore, National Academy of Engineering – Observation 6.2

[34] PAME, 2013a—Report: Findings and Recommendations of the Health, Safety and Environmental Management Systems Workshop, p. 15

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.

5.7 Accountability and Responsibility

Issues and Considerations

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

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

The operator is also responsible for establishing and maintaining clear lines of responsibility and accountability with, and among, contractors and subcontractors. 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 flow through everyone in the operator's 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 precisely to the Arctic. Lines of authority can sometimes be blurred or unclear between the field and 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; and
  - Skewing authority and accountability toward simply getting the job done.
- Maintaining strong, direct management/supervision and dealing clearly and effectively with layers of contractors, subcontractors and sub-subcontractors in the Arctic petroleum industry; and
- 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 identify 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 being undertaken.
- ➢ While field inspection programs can be expensive to implement, the regulator must be prepared to support robust inspection programs.

5.8 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 followed[35] 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)

How the Arctic environment can affect human factors, materials, equipment and procedures must be clearly understood. These aspects which can significantly impact safety and environmental protection must be carefully assessed industry-wide and processes implemented to adjust subarctic standard operating practices and work procedures that may not be fully transferable to all Arctic regions.

Improper operating practices have been a key factor in many offshore accidents and warrants greater 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.

There are efforts underway to standardize some of these operating practices, most notably through the International Organization for Standardization (ISO)[36] (see Section 4.2 and Appendix D). The United States is proposing new standards for their Arctic operations[37] (See Appendix E). The Arctic Council has recently established a Task Force on Oil Pollution Prevention that will develop an Action Plan and related cooperative arrangements (including the pursuit of agreed best practices) by 2015.

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;

[35] PC, 2011-- National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling Report to the President, Chapter 4

[36] Barents 2020, 2012 Report on Standards Development for the Barents Sea by Det Norske Veritas (http://www.dnv.com/resources/reports/barents2020.asp)

[37] U.S. Senate testimony by Department of the Interior Assistant Secretary Tommy P. Beaudreau, Regarding Current and Anticipated Future Marine Activity in the Arctic and Lessons Learned from Shell's 2012 Alaska Offshore Oil and Gas Exploration Program http://www.boem.gov/uploadedFiles/BOEM/Newsroom/Congressional_Testimony/BOEM%20Shell%20Arctic%20Oil%20and%20Gas%20Review%20Testimony.pdf

- 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 and variable conditions in different regions and seasons; and
- 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 review any proposed modifications by the operator in response to Arctic conditions or changes expected during Arctic operations. Regulators should also ensure that the risks of these changes are properly considered and analyzed with mitigations identified by the operator.

➢ The regulator should monitor all critical operations, through onsite inspections, 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.

➢ 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.

5.9 Quality Assurance & Mechanical Integrity

Issues and Considerations

Equipment and facilities typically used in Arctic offshore operations may be more prone to failure and, therefore, must be able to withstand the extra stress created from operating in such 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 found to be key deficiencies in the Deepwater Horizon/Macondo well disaster[38]. The assessment of Shell Oil Company's 2012 operations in Arctic Alaska also found that contaminated fuel on the towing vessel and the failure of a shackle of questionable origin[39] on the tow rigging may have contributed to the grounding of the *Kulluk* drilling unit while being towed from Alaska to Seattle, Washington.

Challenges

- Components for equipment and facilities may be especially scarce or difficult to replace;
- Depending on location, short exploratory drilling seasons (which may last only 2-3 months) can generate added pressure to perform makeshift repairs or delay maintenance in order to meet operational schedules; and
- Access to, and maintenance of, equipment may be adversely affected due to remoteness and difficult working conditions.

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 properly.
- ➢ Regulators should 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.

5.10 Documentation and Reporting

Issues and Considerations

Improving safety systems such as risk management, quality assurance, maintenance tracking, and adjusting operating procedures, require ongoing monitoring using quality, reliable documentation and reporting. Identifying and advancing improvement initiatives 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.[40] In 2012, the United States Coast Guard (USCG) found that the crew of the drill ship *Noble Discoverer*[41], which had drilled a well for

[38] PC, 2011-- National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling Report to the President, pp. 96-97

[39] 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

[40] PC, 2011, -- National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling Report to the President, p. 138

[41] 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-releases

Shell in the Chukchi Sea earlier that year, did not perform preventive maintenance and audit records were not available.

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; and
- Operational adjustments needed in response to the onset of sudden harsh environmental conditions or unexpected equipment issues may be hampered by working and/or environmental conditions. These incidences may also go undocumented due to pressures to stay on schedule or simple reluctance to record obstacles encountered.

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, non-attribution reporting and trend analyses, be made publicly available.

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)

5.11 Communications

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 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; and
- 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.

6. 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 the safety 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 respond to 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 purely "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 5 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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ASRS Federal Aviation Administration's Aviation Safety Reporting System (http://www.faa.gov/about/initiatives/asap/)

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Appendix A - Table A1 Summary Table of Selected Safety Management Systems Regulatory Requirements for Norway, Canada, Greenland and the United States

Table 1 (A1) Summary Table of Selected Safety Management Systems Regulatory Requirements for Norway, Canada, Greenland and the United States

Safety Element	*Norway*	*Canada*	*Greenland*	*United States*
Continuous Improvement	-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;
Risk/Hazards Analysis	*Risk Management* – 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;	*Risk Management*- 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;	*Risk Management*- 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	*Risk Management*- 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;

Safety Element	Norway	Canada	Greenland	United States
Management of Change	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;
Training and Competence for the Arctic	-responsible party must ensure sufficient manning and competence in all phases of activities ….and 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; -persons under 18 yrs cannot	-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

Safety Element	*Norway*	*Canada*	*Greenland*	*United States*
			work on mobile offshore units;	requirements for personnel and contractors; -must document that all contractors are knowledgeable and experienced to perform their duties;
Accountability and Responsibility	-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;
Operating Procedures/Work Processes	- 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; -procedures and scope of safety plans and environmental protection	-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;

Safety Element	Norway	Canada	Greenland	United States
	health, safety and environment;	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;
Quality Assurance and Mechanical Integrity	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;

Safety Element	Norway	Canada	Greenland	United States
Documentation & Reporting	-responsible party must ensure data on health, safety and the environment are collected, processed and used for monitoring and checking technical, operational and organizational factors; - 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;	- 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; - 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	- site survey requirements with respect to drilling operations must include information on foundation stability, anchor suitability, well and anchor position limitations with respect to e.g. pipelines, cables, etc.; - 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;	- requires program safety and environmental information be developed and maintained for any facility subject to SEMS; - 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
		pollution - these must be readily accessible at each installation;		
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 Regulations[42], for Canada they are from the Canada Oil and Gas Drilling and Production Regulations[43] or the Canada Oil and Gas Operations Act[44], Greenland's regulations and guidance come from the Executive order on health and safety[45] or the Mineral Resources Act[46], and the exploration drilling guidelines (DG)[47], and rules for the United States are from the Code of Federal Regulations (CFR)[48] The text of these regulations can be viewed in the online Supporting Documents at www.pame.is.

[42] 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

[43] Canada Oil and Gas Drilling and Production Regulations http://laws-lois.justice.gc.ca

[44] 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

[45] 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%20på%20mobile%20offshoreanlæg%20ifb%20med%20offshore%20kulbrinteaktiviteter%20i%20Grønland.aspx

[46] 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

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

[48] 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, 2013a[49] and 2013b[50]) and can be found in the online supporting documents (www.pame.is). 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 Guidance document.

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 (NAE), 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 Drilling[51], 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, 2011;
5. Petroleum Safety Authority Report--The Deepwater Horizon accident—assessment and recommendations for the Norwegian Petroleum Industry, 2011.

[49] PAME 2013a Report—Findings and Recommendations of the Health Safety and Environmental Management Systems Workshop, Protection of the Arctic Marine Environment Working Group http://www.pame.is/index.php/projects/offshore-oil-and-gas/hse-workshop-in-iceland-2012

[50] PAME 2013b Report—Findings and Recommendations of the Safety Culture Workshop, Protection of the Arctic Marine Environment Working Group http://www.pame.is/index.php/projects/offshore-oil-and-gas/safety-culture-workshop-2012

[51] National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling Report to the President www.oilspillcommission.gov)

Additional information was drawn from published reports including:

- Petroleum Safety Authority Report--The Deepwater Horizon accident—assessment and recommendations for the Norwegian Petroleum Industry,2011;
- 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 Offshore[52] 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.

[52] NAE, 2011--*Macondo Well–Deepwater Horizon Blowout: Lessons for Improving Offshore Drilling Safety Offshore,* National Academy of Engineering, December 2011, 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 Drilling[53], 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

[53] 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.

Findings:
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 Review[54]
- 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.

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

Response

[54] NEB, 2011. National Energy Board of Canada, Arctic Drilling Review, http://www.neb-one.gc.ca/clf-nsi/rthnb/pplctnsbfrthnb/rctcffshrdrllngrvw/rctcffshrdrllngrvw-eng.html

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.

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.

…[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.

(PAME 2013a, p 13)

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 these specify the information to be submitted in support of an offshore drilling application. This includes 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 (COGOA), regulations and guidelines.

Elements of a Filing Requirement include:

- Context or guidance
    - used as necessary to clarify key filing requirements
- Goal
    - always provided
    - stated as an outcome
    - stated as concisely as possible

• Filing Requirement
  - 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*." [55]

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 evaluate and improve the way it seeks to influence safety in the petroleum industry, and the effect of such influence.

From their study of the Deepwater Horizon accident, PSA identified 4 priority areas for attention:
• Management role in risk management;
• Barrier management;
• Group/Individual risk (occupational noise etc,); and
• Prevention of harm to external environment.

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

- **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.*

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

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 pillars 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 Follow-up." 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 Arctic offshore oil and gas exploration.

Appendix C - Deepwater Horizon and Other Investigations

Table 2 (C1): Deepwater Horizon and Other Investigations

Investigative Body	Reports and Other Documents
United States District Court for the Eastern District of Louisiana	Partial Consent Decree between the USA and Transocean (19 February 2013) Amendment to the Partial Consent Decree between the USA and Transocean (19 February 2013)
Deepwater Horizon Joint (BOEMRE-USCG) Investigation of Deepwater Horizon	Vol.1 (U.S. Coast Guard-Joint Investigation Team) draft report to Commandant 22 April 2011 IADC letter of 31 May 2011 to the Commandant, USCG, regarding the Vol. 1 draft report to Commandant 31 May 2011 BOEMRE Final Report regarding Macondo Well Blowout 14 September 2011 Deepwater Horizon Joint Investigation Team Releases Final Report 14 September 2011 Volume I – USCG Final Action Memo on Vol I 14 September 2011 Volume I – Enclosure to Final Action Memo 14 September 2011 Deepwater Horizon Report Appendices September 2011
Montara Commission of Inquiry	Report of the *Montara Commission of Inquiry* 17 June 2010 Final Government Response to the *Report of The Montara Commission Of Inquiry* 25 May 2011
BP	*Deepwater Horizon* Accident Investigation Report 8 September 2010
Transocean	Macondo Well Incident: Transocean Investigation Report, Vol. I June 2011 Macondo Well Incident: Transocean Investigation Report, Vol. II June 2011
The National Commission on the Deepwater Horizon Oil Spill and Offshore Drilling	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. A Brief History of Offshore Oil Drilling 23 August 2010 Decision-Making Within the Unified Command 11 January 2011 The Amount and Fate of the Oil 11 January 2011

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

	Chief Counsel's Report 17 February 2011 Final report of the *National Commission on the Deepwater Horizon Oil Spill and Offshore Drilling* 11 January 20
Oil Spill Commission *Action*	The oil Spill Commission *Action* (OCSA) project is an outgrowth of the National Commission (above) supported of many of the original Commissioners. OSCA Assessment Report on the status of implementation of the Commission's recommendations (17 April 2012)
Republic of the Marshall Islands	DEEPWATER HORIZON MARINE CASUALTY INVESTIGATION REPORT (low resolution version) 17 August 2011
Harvard Law School **Emmet Environmental Law and Policy Clinic**	Recommendations for Improved Oversight of Offshore Drilling Based on a Review of 40 Regulatory Regimes (June 2012) Appendix – Regulatory Programs and Organizations Analyzed January-April 2012
University of California, Berkeley — Center for Catastrophic Risk Management	*"Deepwater Horizon Study Group Final Report on the Investigation of the Macondo Well Blowout"* 1 March 2011
U.S. Chemical Safety Board Investigation of Deepwater Horizon	Investigation currently underway
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	Interim Report on Causes of the Deepwater Horizon Oil Rig Blowout and Ways to Prevent Such Events 16 November 2010 Macondo Well-Deepwater Horizon Blowout: Lessons for Offshore Drilling Safety (Prepublication version) 14 December 2011
Transportation Research Board	Transportation Research Board Special Report 309: Evaluating the Effectiveness of Offshore Safety and Environmental Management Systems June 2012
Petroleum Safety Authority Norway – Macondo Incident	Preliminary conclusions by the Petroleum Safety Authority Norway (PSA) and action recommended after the Deepwater Horizon accident (English summary) 9 June 2011

	SINTEF Executive Summary of report commissioned by the Petroleum Safety Authority May 2011
Norwegian Oil Industry Association (OLF) **Deepwater Horizon – lessons learned and follow up**	OLF's Deepwater Horizon Report – In English (84 pages) OLF's summary Report – In English (20 Pages) June 2012
UK Health and Safety Executive – Deepwater Horizon incident in the Gulf of Mexico	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	Offshore Oil and Gas in the UK – an independent review of the regulatory regime December 2011 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	Proposed ISO/TC 67 programme for drilling, well construction and well operations standards, resulting from the Montara and Macondo accidents (N 1119) 1 March 2011
International Maritime Organization (IMO)	Casualty Statistics and Investigation, Report of the Correspondence Group on Casualty Analysis (FSI 21/5) addressing, *inter alia*, the explosion, fire and loss of the Mobile Offshore Drilling Unit **Deepwater Horizon**
International Association of Oil and Gas Producers (OGP)	International recommendations on well incident prevention, intervention and response Global Industry Response Group recommendations (Summary) May 2011 Oil Spill Response May 2011 Capping & Containment May 2011 Deepwater Wells May 2011

Appendix D - List of HSE Guidance and Safety Culture documents

(Note: Web site addresses are correct as of 3/17/2014)

This list is not meant to be exhaustive and readers are encouraged to search for the vast number of available documents and guidance in print.

Iris and University 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 www.ptil.no/
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)
Safety and Environmental Management System (SEMS) Fact Sheet
http://www.bsee.gov/Regulations-and-Guidance/Safety-and-Environmental-Management-Systems---SEMS/Fact-Sheet.aspx
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
Interim Policy Document January 3, 2013. Explains the policies and responsibilities of BSEE SEMS program management and implementation. http://www.gpo.gov/fdsys/pkg/FR-2013-04-05/pdf/2013-07738.pdf SEMS Implementation IPD 2013-01
Final Safety Culture Policy Statement, U.S. Bureau of Safety and Environmental Enforcement http://www.bsee.gov/uploadedFiles/BSEE/Final%20Safety%20Culture%20Statement.pdf

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/sftycltr/sftycltr-eng.html

Oslo-Paris Commission (OSPAR)

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
https://www.google.com/url?q=http://www.irfoffshoresafety.com/conferences/2011Summit/presentations/Presentation-MarkFleming-Safetycultureandleadership.pdf&sa=U&ei=bbPUUuHXMbDKsQTchYLQAg&ved=0CAUQFjAA&client=internal-uds-cse&usg=AFQjCNHzLXoSstusFhUsMUuPLUuaEtOKZg
Safety Culture Maturity Mark Fleming for IRF
https://www.google.com/url?q=http://www.irfoffshoresafety.com/conferences/2010conference/presentations/930%2520Mark%2520fleming%2520International%2520regulators.pdf&sa=U&ei=bbPUUuHXMbDKsQTchYLQAg&ved=0CAYQFjAB&client=internal-uds-cse&usg=AFQjCNHfz0CD93GgSTOfncjl2OCpp10Nng

Communiqué **International Regulators' Offshore Safety Conference – *Preventing the Next Black Swan*** 25 October 2013
https://www.google.com/url?q=http://www.irfoffshoresafety.com/conferences/2013conference/Communique-IRF-2013-Offshore-Safety-Conference.pdf&sa=U&ei=bbPUUuHXMbDKsQTchYLQAg&ved=0CAgQFjAC&client=internal-uds-cse&usg=AFQjCNGlkUnjhdkIKLtBFCWqpIxN2fUNDw

North Sea Offshore Authorities Forum (NSOAF)
Multi-National Audit "Human and Organisational Factors in Well Control"
http://www.sodm.nl/sites/default/files/redactie/nsoaf%20multi-national%20audit%20_mna_%20report%20-%20final%20-%201%20january%202014.pdf

International Committee on Regulatory Research and Development (ICRARD) primarily has information on HSE-related research and development projects in the USA, Canada, the United Kingdom and Norway. www.icrard.org

G-20
Global Marine Environment Protection GMEP: Best Practices
http://www.g20gmep.org/participating-countries/567-2/

OGP
Safety Committee publications http://publications.ogp.org.uk/?committeeid=41
Management Committee publications http://publications.ogp.org.uk/?committeeid=66

UK Health and Safety Executive http://www.hse.gov.uk/
- **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
Strengthening our safety culture http://www.shell.com/global/environment-society/safety/culture.html

Human Engineering for the Health & Safety Executive

Culture & Work Environments Elements Research Report 365 2005

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
IADC HSE Case Guidelines For both offshore and onshore drilling rigs
www.iadc.org/hsecase/index.html

E&P FORUM
Guidelines for the Development and Application of Health, Safety and Environmental Management Systems Report No. 6.36/210

International Organization for Standardization Documents www.**iso**.org:
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

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 done for over two years 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.

Appendix E - Some Current National Safety Initiatives

(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 Drilling & Production 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 hazard 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:

- Final Safety Culture Policy Statement, U.S. Bureau of Safety and Environmental Enforcement May 10, 2013
  http://www.bsee.gov/uploadedFiles/BSEE/Final%20Safety%20Culture%20Statement.pdf
- The Safety and Environmental Management Systems (SEMS) II final rule (Aril 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 Federal Register September 10, 2013
- Training and Manning on the US OCS Advance Notice of Proposed Rulemaking ANPRM to be published in FR
- 33 CFR Subchapter "N" Update Rule Making Process Supplemental Notice of Proposed Rule Making (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

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[56]; p. 23

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

> ***"Safety cultures are hard to create but constitute irreplaceable avenues to systems safety."***
> (PAME, 2013b, p. 19)

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*" (NEB, 2013)

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

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

The Bureau of Safety and Environmental Enforcement - BSEE (U.S.) defines safety culture[57] 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*[58] 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.

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[56] ACSNI 1993. ACSNI Human Factors Study Group. Third Report: Organising for Safety, Advisory Committee on the Safety of Nuclear Installations, Health and Safety Commission, 1993.

[57] Final Safety Culture Policy Statement, U.S. Bureau of Safety and Environmental Enforcement May 10, 2013 http://www.bsee.gov/uploadedFiles/BSEE/Final%20Safety%20Culture%20Statement.pdf

[58] HSE and Culture, Petroleum Safety Authority Norway, http://www.ptil.no/getfile.php/z%20Konvertert/Products%20and%20services/Publications/Dokumenter/hescultureny.pdf

Attributes of a positive Safety 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 on assuring quality. Another key factor is the underpinning culture that supports the process.

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 follow-up than for traditional inspections or prescriptive compliance verification.

Examples of indicators and metrics for safety culture include[59]:

- 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

- Defining common indicators
- Use of different metrics

[59] 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

- 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 publicly 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 ASAP[60] and ASRS[61].

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 often have far-reaching human, economic and environmental consequences. They typically result from a myriad of causes stemming from unique system technology and/or design deficiencies (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. As was evident in the case of the Deepwater Horizon incident, operators and contractors can have a good occupational safety record while at the same not adequately address their complex safety systems and processes. 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 with robust systems safety vigilance and demonstrated positive safety culture will typically also have a good occupational health and safety program. However, a company with a good occupational health and safety program 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 Bonus[62] 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.

Relying solely on 'lagging indicators' for controlling systems safety is neither practical nor effective since it requires too many major accidents in order to establish statistically valid trends. On the other hand, using 'leading indicators' and near-misses, incidents and identified hazards, can help reveal trends in safety risk 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).

[60] National Aeronautics and Space Administration's Aviation Safety Action Program (ASAP) http://asrs.arc.nasa.gov/
[61] The Federal Aviation Administration's Aviation Safety Reporting System (ASRS) http://www.faa.gov/about/initiatives/asap/
[62] Forbes 4/02/2011 http://www.forbes.com/sites/jeffmcmahon/2011/04/02/transocean-bonuses-deepwater-horizon-gulf-spill/

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 awareness on the part of responsible personnel;
- Overconfidence based on apparent good track record to date;.
- Complacency on the part of operators (and possibly regulators!);
- Difficulty accessing and/or sharing (sometimes proprietary) safety performance data among operators, regulators and the public.
- Demonstrating the benefits of more complex and costly Systems Safety measures and techniques compared to occupational safety approach;
- The need to define, measure, analyze and share leading indicator information for systems safety and safety culture;
- The impact that the complex industry structure and diverse technical expertise can have on the ability to assess and maintain margins of safety;
- Convincing shareholders to spend the time, resources and funds necessary for preventing low probability events;
- Overcoming limited communication and sharing of information between operator and contractors;
- Ensuring regulators acquire the unique skills set and additional training required to effectively 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, hazards, company records, performance review meetings, and worker surveys, etc;

- ➢ Regulators should promote safety by ensuring the operator demonstrates reviewable safety and vigilance initiatives throughout its life-cycle planning and operations;

- ➢ Regulators should ensure that communications and lines-of-authority between the operator and contractors/sub-contractors are clearly established, understood and implemented. The operator should be held responsible for their contractor's safety performance and safety culture by using such instruments as Bridging Documents or other certified agreements or arrangements.

Appendix G - Some Regulatory Coordination Mechanisms[63]

- 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.

[63] 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 D; 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 (Appendix H Table H1). The Arctic *Search and Rescue Agreement* (SARA, 2011) and *Agreement on Cooperation on Marine Oil Pollution, Preparedness and Response in the Arctic* (OPPR, 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, Safety 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 Safety Management Systems and Safety Culture, and recognize their importance in prevention of pollution.

Table 3 (H1) Arctic Council 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)	5.3 Continual improvement p. 21 5 Management System Elements p. 15 3.1 Safety System Elements common in systems failure accidents p.8 5.4 Risk/Hazards Analysis p. 23 5.5 Management of Change p. 26 5.6 Training and Competence for Arctic p.27 5.7 Accountability and Responsibility p.28 5.8 Operating Procedures p. 30 5.9 Quality Assurance/ Mechanical Integrity p.31 5.10 Documentation and Reporting p.32 5.11 Communications p. 34	5.2 Safety Culture p.16 Appendix F Attributes of a positive Safety Culture p.65 5.2 Process versus Implementation p.17 Appendix F Challenges for Positive Safety Culture p. 65. Appendix F Indicators and Metrics p.65 Appendix F Incident and Near-Miss Reporting p.66	4.1 Prescriptive vs Performance Based Regulation p.11 4.2 Common Arctic Standards and Practices p. 13	51. Coordination of the Regulators p. 13
AOOGG Guidance	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	Define and communicate a culture focus on safety and environmental performance and ensure implementation through a management system. p 25	• 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	• 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

AC Product	Topic or Issue			
	Management Systems	Safety Culture	International Standards and Practices	Cooperation and Coordination
	• 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 • Reporting and evaluation of compliance monitoring activities, p. 29 • Human Health and Safety, pp 38-39 • Training, pp 40-41 • Preparedness, p 43 • Contingency Planning, p 43 • Emergency Response Plans, pp 44-45 • 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			• Coordination of inspections, p 29 • Preparedness-- Governments should also make appropriate arrangements that facilitate international coordination and cooperation., p 43
RP3 Technical Report (primarily informational)	*Human Resources and Competence*, p 69 • Safety Culture, p 69 • Training. p 71	Safety Culture, p 65 *Human Resources and Competence*, p 69 • Safety Culture, p 69	*International Standards*, p 23 • Barents 2020 project – Identification and comments to offshore standards, p 24	5.2.1 Barents 2020 project – Identification and comments to offshore standards, p 24 6.5 OSPAR Commission, p 39

AC Product	**Topic or Issue**			
	Management Systems	Safety Culture	International Standards and Practices	Cooperation and Coordination
	• Routines and Checklists, p 71 *HSE and Risk-Based Management System*, p 73 • HSE Definition, p 73 • Management System standards, p 74 • HSE hazards, p 74 • Barrier management, p 74 *Monitoring*, p 77 *Risk tables*, p 89		• International Organization of Standardization (ISO), p 24 • ISO 19906 – Arctic Offshore Structures, p 25 • International Maritime, pp 25-28 6.11 Helsinki Commission (HELCOM), p 42 6.12 Bonn Agreement, p 43 6.5 OSPAR Commission, p 39 6.6 United Nations Environment Program (UNEP), pp 39-40 6.11 Helsinki Commission (HELCOM), pp 42-43 6.12 Bonn Agreement, p 43 *Human Resources and Competence* • Training, p 71 • Routines and Checklists, p 71 • Management System standards, p 74 • Barrier management, p 74 *International Standards* ISO 31000 Risk management, p 62	6.6 United Nations Environment Program (UNEP), pp 39-40 6.9 Norway: preventing, acute pollution pp 41-42 6.10 BSEE Technology Assessment & Research (TA&R) Program, p 42 6.11 Helsinki Commission (HELCOM), pp 42-43 6.12 Bonn Agreement, p 43 Maritime Surveillance in the Northern Sea Basins pilot project, p 43 Create framework conditions for good collaboration in the operator–supplier hierarchy, p 50 circumpolar cooperation regulatory forum, p 80
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.

AC Product	**Topic or Issue**			
	Management Systems	Safety Culture	International Standards and Practices	Cooperation and Coordination
				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)	7.3.2 Point sources of pollution and concentration gradients **R7**. Better reporting and monitoring of point sources of operational discharges and emissions. *Management of Arctic Oil and Gas Development-Laws and Regulations.* AOG p vii • 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 with applicable domestic regulations and		7.3.1. Use of best practices **R2** Require use of best available technologies and practices including consultation, closed-loop drilling, transportation, seasonal restrictions, and monitoring **R3.** Use **c**lear and flexible regulations, compliance monitoring, coordination, adaptive management. 7.3.1. Pollution prevention **R4.** Zero discharge of harmful substances, end or reduce flaring, use less harmful materials and chemicals, conserve, recycle and reuse waste. 7.3.2 Point sources of pollution and concentration gradients **R7.** Better reporting and monitoring of point sources of operational discharges and emissions. 7.3.4. Coordination of research **R39** Coordination of research to provide possible common methodologies, species, and publication guidelines. Use	7.3.1 Use of best practices **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. 7.3.4. Research to improve technology **R25** Cooperate on research to improve oil and gas exploration and development technology. 7.3.4. Coordination of research **R39** Coordination of research to provide possible common methodologies, species, and publication guidelines. *Managing Oil and Gas Development* *Technology and practices*, AOG p. viii Improve international coordination of oil transport information.

AC Product	**Topic or Issue**			
	Management Systems	Safety Culture	International Standards and Practices	Cooperation and Coordination
	monitoring programs. • Continuously improve guidelines and the legal framework for oil and gas activities and oil spill response. *Managing Oil and Gas Development-Spill Prevention and Response* AOG, p viii • 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.		agreed statistically-based standards of analytical quality. *Management of Arctic Oil and Gas Development-Laws and Regulations* AOG p vii Require use of best industry and international standards in laws and regulations. *Managing Oil and Gas Development-Technology and practices* , AOG p. viii 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.	*Managing Oil and Gas Development-Spill Prevention and Response* AOG, p viii Cooperation and emergency communications between operators and local, regional, national and international authorities on routes and schedules of transport and response capabilities need to be established and maintained.
SARA Agreement			Article 7 Conduct of Aeronautical and Maritime Search and Rescue Operations	Article 7 Conduct of Aeronautical and Maritime Search and Rescue Operations Article 8 Request to Enter the Territory of a Party for Purposes of Search and Rescue Operations Article 9 Cooperation Among the Parties Article 10 Meetings of the Parties Article 11 Joint Review of Search and Rescue Operations

AC Product	Topic or Issue			
	Management Systems	Safety Culture	International Standards and Practices	Cooperation and Coordination
AOPPR Agreement			1982 United Nations Convention on the Law of the Sea, the 1990 International Convention on Oil Pollution Preparedness, Response 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 Article 4 Systems for Oil Pollution Preparedness and Response Article 5 Authorities and Contact Points Article 16 Relationship with Other International Agreements	Article 1 Objective of this Agreement Article 4 Systems for Oil Pollution Preparedness and Response Article 6 Notification Article 7 Monitoring Article 8 Requests for Assistance and Coordination and Cooperation in Response Operations Article 9 Movement and Removal of Resources across Borders Article 10 Reimbursement of Costs of Assistance Article 11 Joint Review of Oil Pollution Incident Response Operations Article 12 Cooperation and Exchange of Information Article 13 Joint Exercises and Training Article 14 Meetings of the Parties
AOPPR Agreement Annex IV Operational Guidelines				Notification p. 14 Assistance pp. 14-18 Movement and Removal of Resources across Borders pp.18-21 Response Operations in Areas Beyond National Jurisdiction pp. 8-22 Command and Control 22-23 Facilitation of Situational Awareness and A Common Operating Picture pp.23-24 Joint Review of Oil Pollution

AC Product	Topic or Issue			
	Management Systems	Safety Culture	International Standards and Practices	Cooperation and Coordination
				Incident Response Operations pp.24-25 Reimbursement of Costs of Assistance p. 25 Joint Exercises and Training p. 25 Administrative Provisions pp. 25-26