

Workshop Report



Health Safety and Environmental Management Systems

Keflavik, Iceland, June 10-12, 2012

Cover: The Arctic drilling rig Kulluk aground in Kiliuda Bay, Alaska
U.S. Coast Guard photo by Petty Officer 3rd Class Jonathan Klingenberg. January 1, 2013.

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Workshop Report

Health Safety and Environmental Management Systems

**Arctic Council Protection of the Arctic Marine Environment Working Group,
in cooperation with
the Emergency Prevention, Preparedness and Response Working Group
Keflavik, Iceland, June 10-12, 2012**

Introduction

The workshop was held to gather international experts and Arctic stakeholders to discuss and learn about the use of Health Safety and Environmental (HSE) Management Systems in the Arctic and lessons learned from major accidents and experience. The workshop consisted of presentations and discussions. Workshop participants were asked to consider some issues for discussion but encouraged to contribute their expertise in any topic or subject they felt important to HSE Management Systems.

The HSE workshop was held 10-12 June at the meeting facilities at Hotel Keflavik in coordination with the related Arctic Council Emergency Prevention, Preparedness and Response (EPPR) workshop on Recommended Practices for Prevention of Pollution (RP3), which took place from 11-12 June. The HSE Workshop agenda was coordinated with the related EPPR RP3 workshop agenda on 11-12 June with the aim to ensure that oil and gas experts had an opportunity to attend and contribute as relevant to both projects.

The June 10 presentations were divided into two parts: 1) Results of Deepwater Horizon investigations and regulatory responses in the Arctic and 2) How HSE Management systems are addressed by Arctic regulators from selected agencies.

Presentations¹

June 10, 2012 convened and ran by Dennis Thurston BOEM for the United States.

Introductions

Ambassador Hjalmar Hannesson, Iceland

Dennis Thurston, PAME HSE Project

¹ Found at: <http://www.pame.is/hse-workshop-2012-presentations>

Presentations on Deepwater Horizon Investigations, Reviews, Assessments – HSE:

National Academy of Engineering’s Deepwater Horizon Investigation (Donald Winter, University of Michigan)

Petroleum Safety Authority Norway, Deepwater Horizon Assessment and Recommendations (Magne Ognedal, PSA)

Alaska Oil and Gas Conservation Commission; State of Alaska Hearings on Safety and Environmental regulation (Cathrine Foerster, AOGCC)

National Energy Board of Canada (NEB): Arctic Offshore Drilling Review (Céline Sirois, NEB)

Discussion

Presentations by selected regulators on their HSE systems

Bureau of Safety and Environmental Enforcement, U.S. Safety and Environmental Management Systems—SEMS (Joseph Levine, BSEE)

Petroleum Safety Authority, Norwegian HSE Management Systems (Magne Ognedal, PSA)

Bureau of Minerals and Petroleum (BMP), Greenland’s HSE Management Systems (Jens Hesseldahl, BMP)

National Energy Board, Canada’s Arctic offshore HSE Management Systems (Céline Sirois, NEB)

Arctic Offshore Oil and Gas Guidelines (Dennis Thurston, BOEM)

Summary of Discussions

Discussions after the June 10 presentations and during the Offshore Oil and Gas Breakout Sessions associated with the RP3 workshop produced insight into the differences and similarities of existing (onshore and offshore) HSE Management Systems (HSEMS) and highlighted some of the main elements found to be critical to prevention of “process failure” accidents and pollution incidents.

The main themes included:

- Elements of management systems that may have a “Delta Arctic” risk factor—additional risk for a particular element in the Arctic beyond the risk associated in all regions.
- Occupational health indicators (work loss days; minor accidents and injuries, etc.) were not considered to be a good measure of system process issues.

- There is a plethora of guidance on HSEMS and these can be highlighted by the Report in a referenced list.
- The HSE Guidance contained in the AOOGG 2009 is good but is somewhat scattered throughout and therefore needs to be updated and consolidated in the Report.

Selected summaries of the main issues discussed:

Safety Culture: Demand a safety culture. Avoid complacency that exists in other regions.

Indicators: There is a need to develop safety culture indicators and clear ways to audit for HSE/SEMS compliance. The use of occupational indicators was thought not be relevant to “process safety” issues and major system failure accidents.

Accountability: Clear accountability is a must for operators and contractors and also for regulators (i.e. who amongst multiple agencies is in charge). The operator should be the Responsible Party.

Regulatory Approach: Performance-Based or Goal-Setting Regulatory Approach is favored in the Arctic because there is too little Arctic offshore experience to formulate a comprehensive prescriptive system and also because of possible rapid development of new technologies and practices. Inspect, Regulate, Monitor Performance, Improve Performance, and Penalize. Assess and Monitor more robustly. Eliminate regulatory complexity.

Near misses: Requiring operators to share information on “near misses” will be critical in the Arctic, where experience is essentially non-existent. Learning what almost went wrong is needed for risk analysis and can help others build safeguards into their operations.

Checks and Balances: Consider establishing an independent “Tech Authority” that is separate and independent from operator/regulator that just approve any variances from procedures. Discussion about operator, regulator or third party verifications.

To be effective, it was felt that recommendations should be limited to the most important issues identified, yet still useful for regulators and other stakeholders.

Summary of Presentations

Presentation by Dennis Thurston (Bureau of Ocean Energy Management, United States for PAME)

The PAME HSE Managements Systems Project and the Workshop

In 1997 the Protection of the Arctic Marine Environment Working Group published a negotiated set of non-binding recommendations for operations and activities related to offshore oil and gas aimed at the Arctic national authorities—The Arctic Council Arctic Offshore Oil and Gas Guidelines (AOOGG). These were updated substantially in 2002 and again most recently in 2009, just months before the Deepwater Horizon disaster in the U.S. Gulf of Mexico.

After the Deepwater Horizon disaster, the Arctic Council members asked if their existing guidance, including the AOOGG, was adequate. As preliminary results of the causes of the Deepwater Horizon accident became known, it was evident that human factors—failure of Safety Management Systems and lack of Safety Culture--were the root cause.

PAME decided to review and assess whether the HSE management systems guidance already contained in the AOOGG 2009 could or should be updated or expanded as a result of the Deepwater Horizon accident. The HSE Management Systems (HSE) Project was developed in response. The project was approved by PAME in February 2011 and by the Ministers in May 2011, with a starting date approximately one-year after, in 2012, to allow for results of the various investigations and reviews of the Deepwater Horizon accident and resultant changes in some national regulatory systems to be completed. The project was started officially in early 2012 just prior to the PAME I 2012 Meeting

The first goal of the project is deciding whether the HSE guidance in the AOOGG 2009 is adequate or whether further guidance is warranted. If more guidance is needed, the project would develop recommendations or guidance pertaining to HSE Management Systems in Arctic offshore oil and gas operations.

The project plan calls for assessing existing HSE Management Systems in use by Arctic Countries and this was done by comparing them and looking for common elements, or gaps, and determine if any of the elements could benefit from further guidance in the Arctic context. The project team compiled and compared the HSE Management Systems of four Arctic countries—Norway, Canada, Greenland and the United States, plus HSE Elements from the AOOGG 2009. Thirty three HSE elements identified and compared.

The next step in the Project Plan was for PAME to hold a workshop on HSE Management Systems to gain input from experts, regulators and other stakeholders on the lessons learned from the Deepwater Horizon and other accidents and from recent regulatory reviews, initiatives, and reorganizations. The workshop will provide input on existing guidance and whether the AOOGG 2009 is adequate in this respect., and if there are elements of the HSE Management Systems that can benefit from further guidance in an Arctic context.

Discussions will continue on June 11 in another workshop being conducted by the EPPR Working Group in support of a project on Recommended Practices for Prevention of Pollution (RP3). At the Ministerial meeting in Nuuk Greenland in May 2011, the Arctic Ministers approved the PAME HSE Management Systems project and established a Task Force to develop a binding agreement on Oil Spill Preparedness and Response and further directed the EPPR and other relevant working groups to develop Recommendations for Best Practices for prevention of oil pollution. The EPPR working group held a workshop in October 2011 to scope out some of the possible recommendations and one of the issues was HSE Management Systems. Therefore, in order to cooperate and collaborate between the HSE and RP3 projects, EPPR and PAME decided to hold coordinated workshops.

Presentations on Deepwater Horizon Investigations, Reviews, Assessments – HSE

Presentation by Donald Winter (Professor of Engineering Practice, University of Michigan and chair of the National Academy of Engineering Committee for Analysis of Causes of the Deepwater Horizon Explosion, Fire, and Oil Spill to Identify Measures to Prevent Similar Accidents in the Future)

Macondo Well–Deepwater Horizon Blowout Lessons for Improving Offshore Drilling Safety Offshore, December 2011²

The investigation into the direct causes and systemic underlying issues of the Macondo well blowout and Deepwater Horizon disaster was conducted by the National Academy of Engineering at the request of Secretary of the U.S. Department of Interior, Ken Salazar. The investigation found that the 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

² <http://www.nae.edu/Activities/20676/deepwater-horizon-analysis.aspx>

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.

Operator should be Accountable and Responsible: There is therefore concern that the complex managerial structure of Arctic frontier operations makes integrated systems safety harder to achieve. The only one who has the whole picture is the operating company. But the accountability is not always clear. The operator should be accountable and responsible.

NAE Recommendations:

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.
 - Foster an effective safety culture through consistent training, adherence to principles of human 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.

Concluding Comments

- Neither industry nor U.S. regulators appear to have foreseen the risks of a Macondo-scale event.
- Industry is investing significant resources in capping and containment systems, and regulators are making significant organizational and process changes.
- The question remains as to whether these efforts are a start toward recognition, acceptance, and active management of the risks inherent in offshore oil and gas development or whether they represent a transitory response.

Discussion

Monitoring

In reply to a question about monitoring, it was noted that there is some difference of opinion within industry about whether or not to have some type of shore-based, real-time monitoring. Some in industry feel that it is too much oversight and could interfere with critical decisions on the rig. Professor Winter believes that this type of oversight encourages people to make more careful decisions—that people behave differently when they know they are being watched all of the time. Conferences between onshore and the rig are also important. Concerning government monitoring, Professor Winter believes that there are major points when the regulators should be involved—like negative pressure tests and other critical operations. And the regulator should be knowledgeable and trained in the operations being monitored.

It was noted that BSEE had recently toured real-time monitoring centers for Shell and BP, in the Gulf of Mexico but that the companies say final decisions are devolved to personnel on the rig. It was pointed out that BP did not have a real-time monitoring system in place for the Deepwater Horizon rig during the drilling of the Macondo well. Professor Winter said that a company should decide before hand what kind of decisions should be made onshore or on the rig. He said that "Go" or "No Go" decisions are best made by management because only they have the total picture of the operation and are best placed to understand the totality of risk. A commenter said that Shell will have real-time monitoring in the Chukchi Sea during the summer operations in 2012. It was clarified by another commenter that Shell will have a support center not a control center for their operations because of the concern of loss of communications and that all final decisions will be made by personnel on the rig.

Accountability

A question was asked about whether Professor Winter believed that BP was learning from the Macondo disaster. He expressed his personal opinion that it was hard to determine when corporate lawyers prevent company people from expressing their concerns or opinions—tainting associated with litigation, as he called it. Professor Winter, having been the Secretary of the US Navy, observed a big difference between

the Navy and Industry concerning responsibility. In the Navy, responsibility and liability are absolute. A message is sent that everyone is responsible, especially at the top. And everyone understands that. Professor Winter asked whether BP's CEO at the time of Deepwater Horizon, Tony Hayward, was held accountable? He answered his own question with a "No."

Presentation by Magne Ognedal (Director General, Petroleum Safety Authority, Norway)

The Deepwater Horizon accident—assessment and recommendations for the Norwegian Petroleum Industry

Given that offshore oil and gas operations are not without risk, what do we learn from these incidents and investigative reports?

PSA formed a project team to look at improvement opportunities from lessons learned from the Deepwater Horizon incident. This team looked at a report from Sintef that was contracted by PSA "The Deepwater Horizon accident: Causes, learning points and recommendations for the Norwegian continental shelf"³, and at other Deepwater Horizon accident investigations.

The PSA Study "The Deepwater Horizon accident—assessment and recommendations for the Norwegian Petroleum Industry"⁴ was published.

The main "headlines" are

- Barrier management
- Management's role in managing major risk

Related to barrier management; PSA reviews yearly barrier functionality reports from industry and found a lot of barriers in place do not function according to criteria set for their functionality. This destroys basic risk assumptions for the activity. 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.

³ The Deepwater Horizon accident: Causes, learning points and recommendations for the Norwegian continental shelf

<http://www.ptil.no/getfile.php/Tilsyn%20p%C3%A5%20nett/vrige/Deepwater%20Horizon%20-%20SINTEF%20-%20Executive%20summary.pdf>

⁴ The Deepwater Horizon accident—assessment and recommendations of the Norwegian Petroleum Industry http://www.ptil.no/getfile.php/PDF/DwH_PSA_summary.pdf

The priority for PSA for the last 5 years is defining management's role in major risk management. PSA is moving away from using just accident statistics and is looking at *major risk* with the use of risk analysis techniques. 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.

Implementation: Through an annual planning process, PSA evaluates their supervision and looks at the how to maintain, improve and clarify their regulations. PSA has to internally absorb the results and use these in their daily work. PSA came up with 4 Priorities areas.⁵

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

In Norway there are 3 legs to safe operations--labor, industry, and the regulator. All have duties and responsibilities. OLF is the labor organization and wrote a report on the Deepwater Horizon and published it June 6 "Summary Report--Deepwater Horizon: Lessons Learned and Followup."⁶ A Tripartite Regulatory Safety Forum is organized every year with all three parties including many representatives to discuss all of these issues⁷.

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

Discussion

Responsibility

Industry is responsible for Barrier Management and Well Monitoring. PSA needs information on risks and development of risks in the industry. But it is not PSA's job to monitor wells. It goes to the question of who is responsible—the operator or the regulator. The Operator must present and follow their Safety Case and ensure regulations are complied with. The regulator needs the operator to describe their risk

⁵ <http://www.ptil.no/priority-areas/category173.html>

⁶ <http://www.norskoljeoggass.no/Global/Publikasjoner/Rapporter/DWH-summary%20June%202012.pdf?epslanguage=no>

⁷ <http://www.ptil.no/safety-forum/category167.html>

management and maintenance management, so the regulator can consent. This is where Management systems come into the play.

It was pointed out that with respect to management of liability, there is a big difference in the U.S. and Norway. Because plans and actions are approved in the U.S., in case of an accident, the operator may claim a so-called “affirmative defense” that essentially says, that because they complied with the prescriptive regulations, they have a viable defense against liability. In Norway, plans are consented to, not approved, and that keeps the liability and responsibility on the operator and contractors. Director Ognedal replied that in Norway, they have a work culture where there are no liability “ghosts” for regulators. Everything is discussed with industry. Anything submitted to PSA by the operator, such as investigations, near miss reporting, OSR plans, etc., becomes public unless it contains industrial secrets, which may include some geological and geophysical data, or personal information.

Presentation by Cathy Foerster (Commissioner, Oil and Gas Conservation Commission, State of Alaska)

Alaska Hearings on Drilling Safety

The Hearings were held September 15-16, 2011 to assess if the State of Alaska needed to change their regulations in the aftermath of the Deepwater Horizon incident. A study done by Elmer Danenburger former MMS Engineering and Operations Chief was commissioned by AOGCC and discussed at the hearing.

The Report findings included:

Don't blame deep water. Water depth was minor factor in the Deepwater Horizon disaster.

Demand a safety culture for regulators and operators, from every level.

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

Conduct inspections, enforce regulations, and monitor performance conduct frequent inspections and penalize noncompliance to ensure regulatory compliance. Performance monitoring is critical for identifying problem trends. Monitor everything-- incidents, near misses, system failures, well integrity issues, gas releases. Workers surveys can also be a good type of monitoring. And, the central key is not just the data acquisition but how the data is analyzed and used.

Use safety approach that fits your operators although a Safety Case works for responsible operators, sometimes a prescriptive based system for some operators and

operations. Either/or or a hybrid of both can work as long as you continue to recognize who you're dealing with, which system you are using and why, and what it's drawbacks can be in the given situation.

Keep the regulator focused on regulating the responsibility of regulating should be consolidated into a competent agency or body. Non-regulatory responsibilities should be assigned to other agencies or bodies.

Hold the right people accountable has multiple meanings. 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 understand shared responsibilities. The regulator needs to make sure it regulates and not operates.

Require a blowout contingency plan that is appropriate for the location and well conditions and review it in detail and approve it.

Develop an international database and international standards We need an international database on incidents with complete, accurate and verifiable data and we should develop 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, There is a robust inspection program, they already acquire and analyze performance data for trends, they already maintain focus on regulating, and they already have a system in place that insulates regulators from politics.

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

Discussion

Standards

It was pointed out that it is problematic to develop a set of regulatory approaches that apply across the board—to small companies and to large companies. The question was asked if regulators can require responsibility and accountability by an organization that does not have the technical and managerial competency needed to manage some of these more complex situations. A suggested alternative approach to dealing with operators on a case-by-case basis, would be by establishing standards that everyone must meet. Establish criteria for what expectation the regulator has that the operator and contractors will be able to meet the standards and what the expected standards are for competency.

Relief Well Requirement

A commenter said that establishing standards up front for relief well capability is important due to the planning, cost, and availability of rigs. Another mentioned that it is an important discussion in Canada. Commissioner Foerster explained that if passed, it will be a legislative requirement for State jurisdiction only—from shore to three miles seaward.

Presentation by Celine Sirois (Technical Leader, Environment at the 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 Review⁸

- Drilling safely while protecting the environment

⁸ <http://www.neb-one.gc.ca/clf-nsi/rthnb/pplctnsbfrthnb/rctcffshdrllngrvw/rctcffshdrllngrvw-eng.html>

- Responding effectively when things go wrong
- Lessons learned from other jurisdictions
- Filing Requirements

Phase 1 – Fact Finding and Information Gathering

- Meetings with Northern communities and Aboriginal groups
- Calls for Information and Submissions
- Review of technical reports

NEB conducted 40 meetings in Northern communities with elders, corporations, hunters, trappers, territorial government. Canada has no offshore Northern oil and gas activity yet and none pending. These were introductory meetings to explain the mandate of NEB. The NEB also wanted to hear their concerns.

In response to a Call for Information to participants on the topics included in the Arctic Review scope, NEB received thousands of pages of information, which are posted on their website. Participants suggested topics they thought NEB should study including experts to carry out these studies. Based on this input, NEB asked experts to prepare a number of reports, which are also on their website.

Key Community Concerns

- 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

NEB heard at these meetings that people understand that energy is important and there is a need for energy development but that this development cannot occur anywhere at any cost. It must be done the right way. The unique Arctic environment, including marine and other animals, is an important subject that was raised at every meeting. People in many of these Northern communities told NEB that they are isolated and depend on the ocean. They said that all species, such as beluga, narwhal, char, Arctic cod, polar bear, seal, and walrus, are connected and important to people in the North.

Attendees at the community meetings were concerned that a blowout could completely change their way of life. They asked about the Same Season Relief Well Policy, and many other aspects of drilling, spill clean-up, and the opportunities and risks that would accompany offshore oil and gas activity.

Phase 2 – Considering the Facts and Information

- Provided an opportunity to ask questions and comment on the information collected in Phase 1
- Meetings were held in Yellowknife, Inuvik, Whitehorse and Iqaluit
- \$300,000 was provided to help with travel costs for the Inuvik Roundtable

Phase 2 was concluded in week-long round table in Inuvik, with approximately 200 people including Elders, community members and leaders, local high school students, industry, environmental non-government organizations, labour, experts, other regulatory agencies, federal, provincial, and territorial governments, and land claim organizations. The transcripts are online at NEB's website⁹.

Phase 3 – Public Report

- Public report was prepared and released
- Filing Requirements for future Arctic offshore drilling applications were developed
- Continuing engagement by NEB

NEB developed and published Filing Requirements¹⁰ for operators in the Arctic.

As part of the scope of the Arctic Review, NEB committed to examining lessons learned from accidents, incidents, and emergency response exercises. Throughout the Review, participants were asked to tell NEB what they have learned from their previous experiences with offshore drilling. When the root causes of many incidents were reviewed, a common thread was found: 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.

Key finding 1 of the Arctic Review

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*** - front-line employees are willing to tolerate poor systems, maintenance, or inadequate resources;
- ***deviation from safety policy becomes normal and accepted*** - employees accept that not everyone will follow the rules laid out in organizational

⁹ <http://www.neb-one.gc.ca/clf-nsi/rthnb/pplctnsbfrthnb/rctcffshdrllngrvw/rctcffshdrllngrvw-eng.html>

¹⁰ <http://www.neb-one.gc.ca/clf-nsi/archives/rthnb/nws/nwsrls/2011/nwsrls39-eng.html>

policy, or that the rules do not necessarily need to be followed in order to operate safely;

- **complacency** - major disasters are rare, though catastrophic. Because they do not happen frequently, employees and management begin to feel that they simply will not happen, no matter how high hazard daily operations may be; and
- **work pressure** - the pressure to meet deadlines or cut costs can overwhelm the desire or directive to follow procedures, take precautions, or even stop work if something does not appear to be right.

Det Norsk Veritas (DnV) was commissioned by NEB to conduct a comparison of reports of organizational accidents. DnV concentrated on rare, catastrophic, accidents with wide-spread consequences on uninvolved populations, which occur in systems that have multiple defenses, multiple causes, involving many people, that had judgment and decision-making errors and that have long lasting effects. DnV analyzed a cross section of industries and looked for patterns.

Major Accidents included

- Ocean Ranger offshore drilling rig (1982)
- Chernobyl nuclear power facility (1986)
- Piper Alpha offshore platform (1988)
- Westray mining disaster (1992)
- Longford natural gas facility(1998)
- Columbia Space Shuttle (2003)
- Texas City oil refinery (2005)
- Deepwater Horizon offshore drilling rig (2010)

Management Systems: Policy, Commitment and Planning:

A very clear pattern emerges from this analysis: *Safety policy and commitment statements were present* in each of the management systems, however *hazard identification, risk assessments and the related controls were deficient* in majority of the scenarios.

<u>Management Systems: Policy, Commitment and Planning</u>				
<i>Accident</i>	Management Systems Comparison			
	Policy and Commitment	Planning		
		Hazards Identification	Risk Assessment	Control
<i>Ocean Ranger</i>	X	Ø	Ø	X
<i>Chernobyl</i>	X	Ø	Ø	Ø
<i>Piper Alpha</i>	X	X	Ø	Ø

<i>Westray</i>	X	Ø	Ø	Ø
<i>Longford</i>	X	Ø	Ø	Ø
<i>Columbia</i>	X	X	Ø	X
<i>Texas City</i>	X	Ø	X	Ø
<i>Deepwater Horizon</i>	X	Ø	Ø	Ø

Management Systems: Implementation

The analysis found that common HSE Elements to all of the accidents were the lack of

- Communications,
- Documentation, and
- Management of Change

<u>Management Systems: Implementation</u>							
<i>Accident</i>	Management Systems Comparison						
	Implementation						
	Organi- zational Structures	Roles & Respons- ibilities	Manage- ment of Change	Training	Comms	Document- ation & Document Control	Operational Control
<i>Ocean Ranger</i>	X	X	Ø	Ø	Ø	Ø	Ø
<i>Chernobyl</i>	X	X	Ø	Ø	Ø	Ø	Ø
<i>Piper Alpha</i>	Ø	Ø	Ø	Ø	Ø	Ø	Ø
<i>Westray</i>	Ø	Ø	Ø	Ø	Ø	Ø	Ø
<i>Longford</i>	Ø	Ø	Ø	Ø	Ø	Ø	Ø
<i>Columbia</i>	X	Ø	Ø	X	Ø	Ø	Ø
<i>Texas City</i>	Ø	X	Ø	Ø	Ø	Ø	Ø
<i>Deepwater Horizon</i>	N/A	Ø	Ø	Ø	Ø	Ø	Ø

Very few elements were present or effectively executed. *Management of change* was noted as causal in all incidents. *Communication, documentation and document control*, as well as, *operational control* (procedures to address normal and abnormal conditions) were consistently noted as inadequate.

Management Systems: Corrective Actions & Management Review

Checking and review elements are critical to ensuring continual improvement within the system. They include

- Inspection;
- Measurement and Monitoring;
- Corrective and Preventive Actions;
- Records Management; and
- Internal Audit.

It was also evident that deficient inspections and monitoring; inadequate corrective and preventive actions to address identified deficiencies; poor records management; and lack of adequate management review were also casual factors in these major accidents.

<u>Management Systems: Corrective Actions & Management Review</u>					
<i>Accident</i>	Management Systems Comparison				
	Checking and Corrective Actions				<i>Management Review</i>
	Inspection: Measurement & Monitoring	Corrective & Preventative Actions	Record Management	Internal Audit	
<i>Ocean Ranger</i>	Ø	Ø	Ø	N/A	Ø
<i>Chernobyl</i>	Ø	Ø	Ø	Ø	Ø
<i>Piper Alpha</i>	Ø	Ø	Ø	Ø	Ø
<i>Westray</i>	Ø	Ø	Ø	N/A	Ø
<i>Longford</i>	Ø	Ø	Ø	Ø	Ø
<i>Columbia</i>	Ø	Ø	Ø	Ø	Ø
<i>Texas City</i>	Ø	Ø	Ø	Ø	Ø
<i>Deepwater Horizon</i>	N/A	Ø	N/A	N/A	N/A

Management Systems: Disconnect in Policies vs. Plan--Do--Check--Act (Safety Culture)

When organizational accidents occur, there is often a noted disconnect between the company's vision and policies (what they say) and their planning, implementation,

monitoring and review (what they do). 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 of the Arctic Review

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.

Applicants should 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 of the Arctic Review

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

Key finding 4 of the Arctic Review

Response: Effective response capability is essential in the event of an accident. Industry agrees that they have a key role to play, commencing with Community training before an application is filed.

Filing Requirements for Offshore Drilling in the Canadian Arctic

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

Elements of a Filing Requirement

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

From Filing Requirements: S. 4.7 Safety culture Goal

“The application describes the management system with enough detail to demonstrate an organizational commitment and support for the development and maintenance of a positive safety culture.”

From Filing Requirements: S. 4.7 Safety culture: Example of Clarification of the Goal

3. Requirement for the company to file a detailed description of their safety culture indicators.

6. Describe and provide evidence of the organization’s policy and procedures for safety “stand downs”, including the conditions and activities during which this practice is deemed mandatory.

9. Describe how the organization would implement, maintain, assess, and improve safety culture for a project in the unique Arctic environment when project activities are of short duration or are discontinuous.

Numbers 6 and 9 under S. 4.7 of the Filing Requirements are examples of cultural indicators used to audit or assess Safety Culture.

Discussion

Safety Culture

In response to a question on how Canada audits for compliance of Safety Culture, it was noted that although Canada has not yet had any applications for Arctic offshore oil and gas exploration operations, they have experience in other regions and other operations such as pipelines to draw from. Indicators used to audit for a positive safety culture could include the way a company addressed known inadequacy of machinery, infrastructure, or resources. NEB reviews maintenance logs and concerns raised at safety meetings, etc., and the follow-up as necessary, noting the differences between occupational and process safety indicators. Consequences are greater for process safety issues.

It was observed that there is a difference between management systems and Safety Culture--one is a part of the other. Safety culture is industry's leadership commitment and involvement in implementation of safety. Measuring what management (CEO, Senior Managers) does to make the people on the rig safety conscious and implement the safety management system, uses different leading indicators.

Operator Qualifications

A question was asked about how NEB informs an operator it is not qualified. The answer was that Aboriginal Affairs and Northern Development has Conditions with the license, However, nothing is precluded at the start such as having financial thresholds for a licensee, because the licensee may not be the operator. But it is implied that they may be disqualified if they do not meet the license requirements. If a company does not meet its license requirement (financial for example) it loses its rights. In addition, NEB does an assessment of financial responsibility, and can hold those funds in trust in case a spill occurs.

Industry Standards

There was a comment that the U.S. incorporates industry standards by reference and Canada has moved away from this practice. Then the question was posed as to what are the practical aspects of enforcement in these two approaches? Ms. Sioris replied that the enforceability of standards by the NEB can occur if the operator has committed to applying a certain standard in its approved plans, or where a standard has been incorporated by reference into a regulation the operator must follow. It was noted that the U.S. has incorporated 100 standards in their regulations and may have up to 110, post-Macondo. These include ISO, API RP 75 and 73, IADC HS Standards, The API Center for Offshore Safety has 5 new documents on standards under development. But what the advantages and disadvantages are was not answered.

Permit Review

A question was asked on how NEB reviews permits. Ms. Sioris answered that while the regulations are goal based, with NEB defining the safety and environmental protection outcomes to be achieved, there are some prescriptive requirements including necessary management processes, operational standards and reporting requirements to achieve the desired outcomes.

Environmental Assessments and HSE Management Systems

It was suggested that there is a certain relationship between the Environmental Assessments and the HSE elements like risk assessments but there seems to be a disconnect between the EA and Safety Culture/Management issues. The commenter felt that it should all be in an EA, such as risk assessments and contingency plans etc.

Presentations by selected regulators on their HSE systems

Presentation by Joseph Levine (Branch Chief, Emerging Technologies Bureau of Safety and Environmental Enforcement, United States)

The United States Safety and Environmental Management Systems (SEMS) Program

The Bureau of Safety and Environmental Enforcement (BSEE) regulatory program is a hybrid system whose major components consist of

- Prescriptive requirements for such things as equipment specifications, operational procedures, testing, inspections.
- Performance based initiatives that are goal-setting, and allow for alternative compliance such as in the SEMS/Subpart S.
- Reliance on industry standards of which there over 100 standards from American Petroleum Institute (API), American Society of Mechanical Engineering (ASME), American National Standards Institute (ANSI), National Association of Civil Engineers (NACE), American Gas Association (AGA), International Organization of Standards (ISO) and others.

The Safety and Environmental Management System (SEMS) Program¹¹.

SEMS is an “Add On” to existing regulations and incorporated standards

¹¹ <http://www.bsee.gov/Regulations-and-Guidance/Safety-and-Environmental-Management-Systems---SEMS/Safety-and-Environmental-Management-Systems---SEMS.aspx>

There are four principal SEMS objectives:

1. focus attention on the influences that human error and poor organization have on accidents;
2. continuous improvement in the offshore industry's safety and environmental records;
3. encourage the use of performance-based operating practices; and
4. collaborate with industry in efforts that promote the public interests of offshore worker safety and environmental protection.

Brief SEMS History

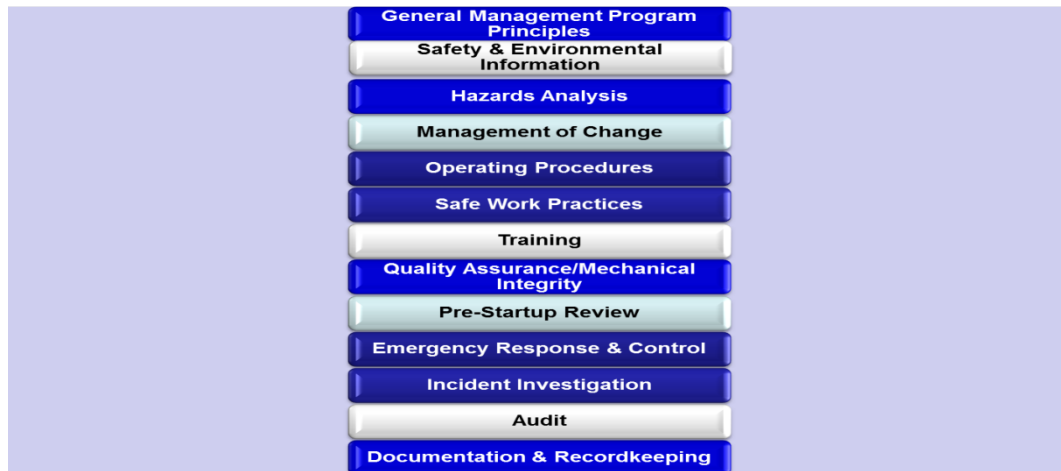
In the mid 1990s until October 15, 2010, MMS and then the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), *encouraged* operators to implement a voluntary Safety and Environmental Management Program (SEMP). On October 15, 2010, the final SEMS rule was released as “Subpart S”¹² of the Code of Federal Regulations (CFR) PART 250. From October 15, 2010 to November 15, 2011 operators prepared SEMS programs and conducted and updated their Hazards Analyses (HA). SEMS became effective on November 15, 2011. Audits have not yet been conducted.

SEMS Major Points/Themes

SEMS addresses both “*Workplace Safety*” and “*Process Safety*” and is composed of thirteen elements taken from API Recommended Practice (RP) 75, 3d Edition with additional BSEE specific requirements on:

- Job Safety Analysis (JSA)
- Recordkeeping
- Audits
- Independent third party (I3P) or designated and qualified personnel (DQP), with a frequency of 2 and 3 years. There is a 3-year Audit Window.

¹² Code of Federal Regulations (CFR) PART 250—Oil And Gas And Sulphur Operations in The Outer Continental Shelf <http://www.ecfr.gov/cgi-bin/text-idx?c=ecfr&SID=0ff7c429669236bf5f30a02d20ff4d74&rgn=div5&view=text&node=30:2.0.1.2.2&idno=30#30:2.0.1.2.2.19>



13 API RP 75 ELEMENTS

SEMS applies to all operations under BSEE jurisdiction including:

- Drilling, production, construction
- Well workover, well completion
- Well servicing, abandonment,
- Department of Interior pipeline activities
- Design, construction, start-up
- Operation, inspection, testing
- Maintenance

SEMS applies to all facilities under BSEE jurisdiction including:

- Mobile Offshore Drilling Units (MODU), Floating Production Systems (FPS), Floating Production Storage and Offloading (FPSO)
- Fixed facilities, caissons
- Tension Leg Platforms (TLP) and Spar Platforms
- Manned and unmanned
- Department of Interior regulated pipelines

Required Hazards Analysis (HA)

In the U.S., a Hazards Analysis is roughly equal to, and takes the place of, a Risk Assessment Process.

- Facility level HA is required
- The operator free to determine HA methodology, which can use qualitative and/or quantitative techniques
- The HA needs to be updated when change is implemented on a facility
- The HAs for simple or nearly identical facilities can be combined
- There are currently no plans for BSEE to move towards a “formal” risk assessment, quantification of risk, or the "As Low as Reasonably Practicable" Principle (ALARP)

Contractor Management

- Contractors not required to have a SEMS
- Operators SEMS needs to document contractor selection criteria
- Operator & contractor must document their agreement on appropriate contractor safety and environmental policies (bridging document)
- Operator needs to verify that contractors have safe work practices
- BSEE will include direct oversight of “major” contractors
- Operator to verify contractors are trained to perform jobs safely

For contractors, currently BSEE only requires the Operator’s SEMS to cover the Contractors Safety and Environmental Policies. However, there is discussion in the SEMS review about taking more direct regulatory control in SEMS II. Maybe along the lines of the PSA Norway AoC.

Miscellaneous Provisions

- JSA (task level) needs to be conducted for activities identified in your SEMS
- BSEE does not “approve” SEMS

BSEE will work with operator to see continual improvement in SEMS, however typical enforcement actions remain available

BSEE does not “Approve” SEMS. It is similar to continuous improvement.

In an analysis of 1000 Accident Investigations in the U.S. Outer Continental Shelf, failure in addressing four SEMS elements were common to all accidents.

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

Future Initiatives – “SEMS 2”

SEMS continues to evolve as a result of Deepwater Horizon reports and findings and other analyses and activities. BSEE issued a notice of proposed rule on “SEMS 2” that would add to SEMS:

- The requirement for an independent third-party audit only and removing the option for a DQP.
- The requirement to identify an individual as the Ultimate Work Authority
- Stop Work Authority
- Job Safety Analysis enhancements for repetitive operations
- Unsafe Work Practices
- Employee Participation Program

The comment period for this proposed rule ended November 14, 2011 and a final rule is expected to be published in the Fall of 2012.

PAME HSE Project – Possible Next Steps

PAME has already done a compilation and preliminary evaluation of the different HSE program elements in effect for Norway, Canada, Greenland and the U.S., which shows both commonality and differences. Perhaps agreement can be reached on further guidance to develop inputs into certain HSE elements, such as;

- HA (type, frequency of occurrence)
- meteorological concerns (weather, ice, darkness)
- logistics, communication
- containment caps

Discussion

Arctic Focus on Accident Causes

For the purposes of the HSE Management Systems project, it was suggested that inclusion or focus on Occupational Safety issues might get too complicated and overshadow addressing major accident risk in management system. It was pointed out that the United States Navy “Sub-Safe” program instituted after the USS Thresher accident, focuses on 2 issues only--can a submarine survive a dive and can it resurface. Since, risk is Probability vs Consequence of Failure, perhaps the PAME HSE project report could have an Arctic focus on the 4 elements common in the 1000 U.S. accident investigations-i.e. Hazards Analysis; Operating Procedures; Integrity; and Management of Change.

Near Misses

The BSEE has investigated 1000 accidents as of January 2006 but the regulations do not require reporting of near-misses. There is work underway in industry through the Center for Offshore Safety (COS) to determine trends from near-misses and the OSAC [Overseas Security Advisory Council] is also concerned about this. It was suggested U.S. Federal Aviation Administration-type reporting could serve as a possible template for reporting near-misses.

Training and Competency

Concerning SEMS rules that operators require contractors to have training, a question was asked whether the BSEE inspectors test and drill the contractors. It was noted that BSEE does not inspect or drill contractors, but that SEMS regulations require that the operator must show they have a way to verify their contractors training is appropriate and adequate. A commenter added that in SEMS the requirement is for Competency

and Training. Training for Mobile Offshore Drilling Units (MODUs) is being updated by ISO.

SEMS Acceptance vs Approval

It was emphasized that SEMS is not “approved” by BSEE, but is “accepted” if it addresses regulations, risks and hazards, etc. BSEE then holds the company to the SEMS provisions and mitigations.

Presentation by Magne Ognedal (Petroleum Safety Authority, Norway)

Norwegian HSE Management Systems

The responsibility for Health Safety and the Environment in offshore Norway is split between Petroleum Safety Authority (PSA), Climate and Pollution Control Agency (KLIF), and the Health Administration.

For the PSA, **Priority One** is People and **Priority Two** is the Environment

PSA’s program is

- System Oriented
- Risk Based (probability and consequence, so that if the Risk changes, the regulations don’t have to change).
- Balanced (major risk elements versus individual risk)
- Accountability Awareness (distribution of responsibility on license applications)

Tripartite Cooperation (Industry, Labor, Government)

Norway uses a License Application process, not a bidding system to transfer exploration and production rights to an operator. This is based on qualifications. The Ministry of Petroleum and Energy chooses participants and chooses operators. Responsibility is assigned to the License Group (Board of Directors) or the Operator (CEO).

To regulate these operations, PSA uses a performance-based system and follows up with Guidelines and Reference Standards. There is a “See-To” duty in this system; PSA must see-to-it that the operator is complying, and the operator must see-to-it that the contractors are doing their duty.

In the Norwegian system, planning is Risk-Based. The PSA does not “approve” nor “accept” plans but instead ensures compliance based on a system Audits and Verification. System Audits are conducted on a risk-based prioritization schedule. Conclusions address improvement opportunities in the main systems and management systems.

Norway has a “Consent Regime” in which the PSA consents to the start of activities and expresses the PSA’s confidence in the plans. Consents are activity oriented. The operator is responsible and must ensure continuous compliance. In some cases consent has been denied because of an applicants lack of demonstrable competence (such as for a new organization with no history). Consents can take from one to two months to be issued, except for “Life Extensions.”

Industry Standards: BSEE in the U.S. incorporates Standards (partially or wholly) by reference as Rules. Whereas, Norway, Canada, and Greenland as Suggestions.

Acknowledgement of Compliance (AoC); The AoC was formerly voluntary but is now required. A rig owner needs an AoC to market the rig in Norway. The AoC’s cover all types of activity and may be required from the Rig Owner to the Drilling Contractor. The AoC is not an Approval. The Operator must do a Gap Analysis.

The Gap Analysis is

- Risk-Based
- Identifies Non-Conformities
- Institutes Dialog for improvement.
- Uses a Near-Miss inventory for trends.

Enforcement is based on the Continuous Improvement Cycle. This is a Tool for describing “risk-wise’, how a company is doing. A report pointing at Development of Risk Indicators for incidents, accidents, release of gas etc., are done yearly, every April.

Discussion

It was suggested that the Norwegian Acknowledgement of Compliance (AoC) allows the operator to focus on key systems-safety issues instead of occupation safety.

It was noted also that oil and gas activities are exempt from the Norwegian Pollution Control Act.

Presentation by Jens Hesseldahl (Greenland Bureau of Minerals and Petroleum¹³)

Greenland Health, Safety and Environment Systems

Greenland has Offshore Oil and Gas License Rounds approximately every two years. The last included issuing 20 license blocks comprising 200,000 square km to 9 companies. There will be no drilling in 2012. In 2013, Shell/Husky/Cairn plan to drill licenses.

¹³ <http://www.bmp.gl/>

Legal Foundation for Regulation of Offshore Oil and Gas Operations in Greenland:

Act on Greenland Self Government. Greenland is an autonomous part of the Kingdom of Denmark and the Greenland Self-Government was formally established by a Danish **Act on Greenland Self-Government** on 21 June 2009.

- The legislative and executive powers for the mineral resources area was the first to be transferred
- The Greenland Mineral Resources Act¹⁴ was adopted by the Greenland Parliament (Inatsisartut) in December 2009 and it came into force on 1st January 2010

The Greenland Government has jurisdiction over:

- Greenland land territory,
- internal waters,
- territorial sea,
- continental shelf and
- exclusive economic zone.

The Bureau of Minerals and Petroleum (BMP) based in Nuuk, Greenland and was established 1998. BMP is the place of entry for all aspects of administration of minerals and hydrocarbons; the "one stop shop" principle. BMP has agreements for cooperation with GEUS (Geological Survey of Denmark and Greenland) and DCE (Danish Center for Environment and Energy, Århus University), which are scientific, independent advisors to the Government.

The Bureau of Minerals and Petroleum of the Greenland Government:

- Sets up rules, provisions, terms, guidelines
- Issues approval of activities, including contingency plans
- Conducts inspections, issues orders or enforcement notices to ensure compliance

Inatsisartut Act on Mineral Resources (MRA)

- Mineral Resources Act is a framework act that requires application of best international practices
- MRA rules on HSE is a non prescriptive, performance-based regulation, with emphasis on continuous improvement
- MRA has adopted the "As Low as Reasonably Practicable" (ALARP) standard for health and safety risk reduction for offshore facilities

¹⁴ The Mineral Resources Act ("MRA")

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

An Executive Order on Health and Safety for offshore operations is being finalized

- The BMP has issued a number of guidelines¹⁵, including on EIA, SIA and Exploration Drilling
- BMP Drilling Guidelines make reference to NORSOK¹⁶ standards
- All offshore activities are subject to approval by BMP. The approval letter stipulates a number of specific **terms** and **requirements**

The Executive Order has a statement on Management Systems.

The BMP has issued Environmental, Social, and Exploration Drilling guidelines. No major work can be done without an EIA and Social Impact Statement. BMP guidelines make clear reference to NORSOK Standards as a basis (and are adopted as National Standards for Greenland). If a company deviates from them, then more documentation and prescription will be required. If NORSOK Standards are used, there is no such prescription. It is a balance of prescriptive and goal based regulations.

HSE requirements for selection of licensees

During the Pre-qualification process an applicant must document:

- that the operator can carry out activities in accordance with good international practice as established for hydrocarbon activities conducted under similar conditions
- that the HSE-organization of the operator is in line with internationally recognized standards, and
- that the collective licence group has the necessary financial capability to carry out exploration and exploitation in the Licence Block(s) applied for

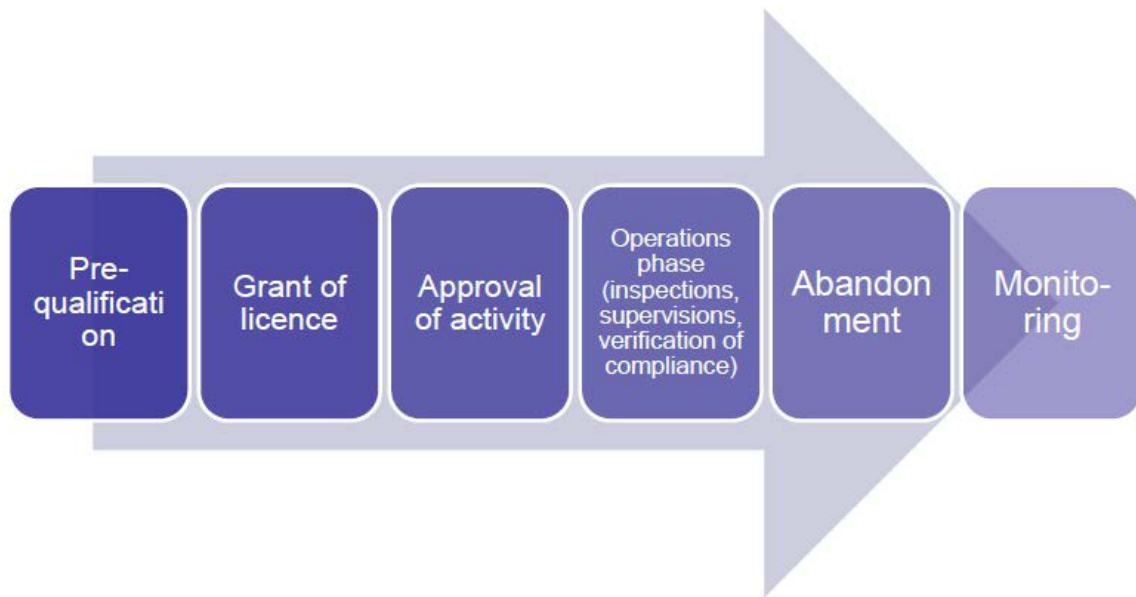
After the prequalification process there are selection criteria for licenses. These are:

- The applicant's technical capability
- The applicant's financial capability
- The way in which the applicant intends to explore and begin exploitation of (bring into production) the area comprised by the application (any and all proposed license area(s)), including: the **applicant's systems and procedures in relation to Health, Safety and Environment (HSE)**, and
- The applicant's willingness and ability to explore thoroughly for hydrocarbons in the area comprised by the application

¹⁵ <http://www.bmp.gl/petroleum/approval-of-activities/exploration-drilling>

¹⁶ NORSOK Standards <http://www.standard.no/en/>

Focus on HSE aspects throughout life cycle



Life Cycle

HSE is important throughout all stages or phases.

An operator might be unqualified for the full exploration program and not be authorized for drilling but could initiate seismic surveys. In such a case they would have to enter into an agreement or partnership with a qualified operator. Currently Greenland has had only major oil companies as operators--GasSwiss, Conoco, Shell, and Husky.

At this stage, competent and responsible *licensees and operators* are appointed.

Approval to drill

After a license has been issued, the next phase is Drilling approval. The licensee must submit an application that describes their safety culture and risk assessment, which are contained in NORSOK standards.

Based on their hazard identification study (HAZID), hazard and operability study (HAZOP) and Risk Assessments, the licensee is required to establish and maintain:

- an ice management response system
- oil spill and pollution plan
- relief well drilling plan and program (dual rig requirement and no-drilling in sea ice)
- emergency preparedness plan for major accidents
- environmental management plan

Greenland recommends using NORSOK standards for Well Integrity in Drilling and Well operations, System Requirements for Well Testing System, Technical Safety,

Environmental Care, and Risk and emergency preparedness. The licensee must demonstrate careful monitoring of simultaneous operations (SIMOPS), extensive use of Safe Job Analysis and Work Permit systems. In addition, they must provide BMP with detailed written programs and procedures for each part of operations, as well as, requirements regarding training of personnel and conduct of drills.

HSE requirements for management processes, controls, and safety culture (i.e. through stop-cards), are a special focus of the BMP.

The BMP has a rule that only one rig at a time is allowed to drill into oil-bearing layers in order that a relief well could be drilled without abandoning another operation. There is no drilling allowed in sea ice and a rig must move off location before the ice returns. This results in a 6-8 week drilling window to allow drilling of a relief well in ice free conditions.

The BMP recommends that licensees use Norwegian NORSOK standard for barrier identification in all operations (acceptance criteria for design, testing, verification and monitoring of barriers and barrier elements).

- All planned operations must identify and consider any potential external threats for the duration of next operation
- T-time: Time to react and safely postpone operations in case of external threat
- T-time includes time for installing additional mechanical barriers in the wellbore before suspension

NORSOK standards require at least two barriers at all times and T-times established for ice berg incursions—either moving off location or moving the ice berg.

NORSOK are used as National Standards in Greenland and incorporated in the Drilling Guidelines. Compliance with the Drilling Guidelines is required for an approval to drill. However, the operator can substitute different but equal or better operating standards for review. One of the reasons BMP uses NORSOK is that they employ Norwegian Advisors for inspection and compliance.

Discussion

Bi-lateral and multi-lateral Cooperation

In response to question about whether Greenland has practical technical cooperation with Canada as well as that described with Norway, it was noted that the National Energy Board of Canada and the BMP signed an agreement allowing NEB inspectors on Cairn's rig in 2010, just before DWH, as a result of concerns in Canada about pollution and spills. There was also an agreement between Denmark and Canada signed in 1983. It was suggested by a commenter that this type regulator-to-regulator cooperation and practical exchanges may be something to consider as a recommendation of the workshop. Another participant agreed that this serve as a good

model for bilateral (and multi-lateral) cooperation between Greenland-Canada, Canada-U.S., and U.S.-Russia and be something the Arctic Council could facilitate.

Presentation by Celine Sioris (National Energy Board of Canada)

Regulatory System of the National Energy Board of Canada

Canada does not currently have any offshore drilling operations; therefore, the implementation phase of their regulatory program for offshore drilling and production is based on how policies are implemented in other sectors where they have current operations, such as pipelines.

The NEB Regulates with a combination of goal-oriented (performance-, or outcome-based) and prescriptive requirements.

NEB Approach to the Design of Regulation



Goal Oriented

Define HSE outcomes to be achieved, employing a goal-oriented approach that allows flexibility for most appropriate means of achieving the outcome. It allows innovation and the use of appropriate or new technologies. The operator has to persuade NEB that they have chosen the appropriate means to achieve those outcomes. In the Drilling and Production Regulations it says “the operator shall take all reasonable precautions to ensure safety and environmental protection”—which is clearly outcome-based.

Prescriptive

NEB then prescribes the necessary management processes, operational standards, and recording requirements to achieve the desired outcomes. Prescribing methods allows the NEB to identify the means to achieve an outcome and more importantly gives the NEB tools to verify compliance. An example of a prescriptive element is “The applicant shall develop an effective management system that integrates operations and technical systems for the management of financial and human resources.”

Regulatory Development

Drilling and Production Regulations¹⁷ went into effect in 2009. They are outcome-focused and contain eleven management system components covering the full suite of “Plan–Do–Measure–Improve” processes. How each element is administered will vary based on the facilities, activities and administrative practice of each company corresponding to the size, nature and complexity of the companies activities authorized under the Act and the regulations, and the associated risks. The regulations require management system components

- to set company policy and performance objectives,
- to proactively identify hazards,
- to evaluate risk,
- for mitigation,
- for clear responsibilities and accountability,
- for trained and competent personnel,
- for management of documentation, and
- for continuous improvement.

The Drilling and Production Regulations require only that the well and casing is designed so that it can be drilled safely.

Regulatory Challenges-Setting Expectations

Clarity

Canada has found that it is sometimes unclear to companies how to comply with regulations in an outcome-based system. A clear articulation of management system requirements is therefore required. The NEB issues *Guidelines* and *Interpretation*

¹⁷ Canada Oil and Gas Drilling and Production Regulations (SOR/2009-315), <http://laws-lois.justice.gc.ca/PDF/SOR-2009-315.pdf>

Notes¹⁸ to clarify how these regulations will be put into practice. Guidelines may cover a wide range of topics, including

- the NEB's expectations for complete information to be provided in applications for authorizations (Filing Requirements),
- information about how the NEB considers best practices, standards, equipment and methods, and
- its views about acceptable means of compliance.

The onus remains with the operator to comply with the regulations and to be able to demonstrate to the NEB the adequacy and effectiveness of the methods employed to achieve compliance.

Current requirements and guidance include the Safety Plan Guidelines and Environmental Protection Plan Guidelines (March 2011) and the Filing Requirements for Offshore Drilling in the Canadian Arctic (December 2011)¹⁹. The NEB Strategic Plan 2012-2015 will focus on developing guidance for the D&P Regulations on Data acquisition, Incident reporting, Geotechnical considerations, Well abandonment and suspension, and Financial responsibility, as well as, on creating performance measures and audit protocols. Outreach will be required to increase awareness and understanding of all products developed.

Implementation

Monitoring Compliance with Requirements

Compliance is assessed against:

- Statutes and regulations
- Commitments made during an application process
- Conditions on authorizations
- Company programs for managing technical areas
- Other direction provided by NEB from time to time such as security letter, safety directives and operations and maintenance (O&M) activities

Companies who purchase NEB regulated facilities are responsible for the conditions placed on the original operator and the commitments made by the previous owners to stakeholders.

Canada believes that when a management system approach is applied, companies become accountable.

¹⁸ <http://www.neb-one.gc.ca/clf-nsi/rthnb/nrthffshr/pblctnrprt/pblctnrprt-eng.html>

¹⁹ <http://www.neb-one.gc.ca/clf-nsi/rthnb/pplctnsbfrthnb/rctcfffshrdrlIngrvw/rctcrvwflnqrqmnt/rctcrvwflnqrqmnt-eng.html>

Risk-Based Life Cycle (RBLC) Regulatory Principles

- Companies are accountable for their own performance
- The NEB manages its resources to ensure that regulatory oversight is prioritized according to risk
- The NEB regulates according to risk throughout the lifecycle of facilities within its jurisdiction
- The degree of regulatory oversight is directly linked to company performance

In the RBLC - Company Prioritization Model, *Risk Prioritization = Probability x Consequence*, where Probability is a function of Adequacy, Appropriate Implementation and Effectiveness of the Management System.

The development of the NEB's annual compliance verification plans involves a calculation of risk as a function of consequence and probability. Probability is likelihood of the impact based on the regulated company's program performance. Consequence is the severity of the impact of a regulated facility on receptors (e.g. people, land, water). Adequacy and Implementation mean that all the elements of a management system are included within a company's management processes, associated practices, and activities, and they are measured through the NEB's compliance verification process. Effectiveness means the degree to which the management system is achieving safety, security and environmental protection goals, and is measured through the use of leading and lagging indicators, incidents and trends.

Compliance Verification Activities

There are many tools in the "tool box" to verify compliance and to inform the regulators own compliance verification plan process. Early in the process, NEB has information exchange meetings with the operator where background information on the regulatory process is provided. These meetings help establish relationships, improve the operator's understanding of regulations, and help inform NEB's compliance verification process. Compliance screening meetings are also used to obtain information on specific company programs. These meetings also help identify issues to consider in the future, such as areas for focused audits or inspections. In addition, NEB conducts inspections. In the Beaufort Sea, the consequence portion of risk calculation is very high so NEB will likely have inspectors twenty-four hours a day for seven days a week.

NEB uses audits to determine the adequacy of a company's management system and associated programs, processes and procedures. If there is a finding of deficient management systems, companies have to submit a Corrective Action Plan to mitigate or correct the deficiency. The results of these are used to inform future NEB compliance verification activities. Implementation Assessment Meetings are another tool to assess how well management systems are implemented. NEB also holds

Assessment Exchange Meetings with the operator to provide feedback on their program areas to senior management of the company.

Regulatory Challenges - Operational Implementation

There are challenges in implementing management system frameworks.

- Distinctly different set of skills required for regulatory staff
- More time consuming for staff
- Data is the driver
- Varying maturity level across regulated organizations

Verifying management system compliance requires a different skill set for regulatory staff. It requires training, education, tool development, and hands-on experience in inspection and auditing because more professional judgment will be required. A checklist approach used in a prescriptive system will not help much because of the interdependencies in parts of the management system. Therefore, additional investigation is required compared to the traditional way of inspecting. As a result, it takes additional time for staff to complete compliance work. And this workload needs to be planned and managed differently than in past prescriptive systems. NEB uses risk profiles to manage workload needs better.

An additional way to relieve NEB's workload is to provide the company a matrix or a list of questions with section references to various NEB requirements in the regulations to help them demonstrate how they are complying, instead of just receiving a management system binder.

Data is a central part of management systems regulation. Data drives NEB's decisions around compliance work and NEB deals with large amounts of data. Therefore, it is important to have a centralized data repository that has information on all incidents, audits etc. This helps determine risk profiles and appropriate compliance verification actions.

Lastly, NEB has found that there are varying maturity levels across regulated companies. In some cases NEB has to educate a company during oversight activity which often leads to pushback and controversy over the compliance grades a company may get during the audit review process. NEB feels that this is mainly because they are learning the elements and there is a substantial amount of subjectivity and interpretation.

Discussion

Compliance Grading

In response to the question as to whether NEB issues "grades" to the operator on their management system, it was confirmed that NEB grades a company's performance. If

an operator gets a grade that shows a high level of management deficiencies that means that they will get a higher level of regulatory scrutiny.

Compliance Review

A participant asked how NEB would proceed with review of a plan if they did not think it met their criteria. For example, since NEB regulations required only that a casing design is to be “adequate” what happens if an operator submits a design that NEB thinks is not, how do they decide without prescriptive regulations to reference? Ms. Sioris replied that NEB Guidelines will help ensure that the design is adequate and they must follow the Filling Requirements and demonstrate how they will do it safely. There is often some degree of professional judgment involved by technically competent NEB experts. NEB audits and inspects to see if they are complying with their commitments. It was noted additionally, that there is some level of specificity in the regulations, the requirement for daily well records for example.

It was noted that in State of Alaska statutes, it says that if an operator meets the requirements, they must receive a permit to drill.

Near Miss Reporting

Canada requires in the regulations the reporting of near misses. It was noted that State of Alaska and BSEE do not. It was noted that different entities have different definitions of what a near miss is. For example in a crane lifting operation, if a tool drops and misses a person by 10 feet, that is not a reportable incident in the U.S. The U.S. also has a financial requirement in our reporting regulations with a threshold of \$25,000 in damage, above that amount it must be reported. It is not straight forward and can get confusing.

BMP Greenland has a requirement for daily morning conferences between the rig and headquarters, which they attend every morning and receive information on any incidences no matter how small, as well as, near misses. These are monitored and when an accident, incident or near miss occurs, BMP can issue a notice or warning and can help the operator improve. This reinforces their Safety Culture

It was noted that this may be an identified a gap, the definition of near misses. And suggested that it was not just an offshore oil and gas issue but one for maritime disasters as well and their definitions.

Kicks and Reporting

A participant suggested that another good subject to for this project is to look at is Kicks while drilling. Depending on the operation, this could be a near miss or standard operating procedures such as managed-pressure drilling. Do near misses include kicks? The United States does not require reporting kicks. In the Alaska region, BSEE gets that information with the morning or weekly drilling reports, but the Gulf of Mexico there are so many wells BSEE cannot handle the volume of paper or electronic data. Since the 2009 Drilling and Production Regulations, Canada also gets Kick information from the well data submitted. These daily reports are received within 24 hours of the activity. Although the NEB is reviewing this, the Canadian Petroleum Resources Act makes much of this drilling information privileged, and it will not be made public unless the company gives permission to release it. It was noted that weekly drilling reports are filed in OCS Alaska but not released.

Open Discussion Wrap-Up, June 10

In response to a general call for discussion about the workshop, several people offered concluding thoughts.

Managing Risk

Employ **Safety Margin Management** as a proactive approach to ensure that margins of safety are established in the design phase. It then becomes a process of trying to preserve that margin during the drilling of the well.

The questions to answer are:

- What is adequate?
- What is proven practice?
- What type of uncertainties are we dealing with? Depending on those uncertainties, you may need different levels of margins.
- How do you factor in the differences in exploration and production operations and geology?

There was a recommendation to use a **Bow-Tie Risk Analysis** in the AOOGG Risk Analysis Section follow-up. With a Bow-Tie, you have barriers on both sides. If the incident gets past prevention barriers and it gets into capping and containment, for example, there is an explicit understanding of how many barriers are in place, and importantly, a better assessment can be made of the ability to manage the overall risk.

There was a recommendation to consider a factor of risk besides the probability of occurrence and the consequence--namely the ability to **Monitor Risk**. If a risk is monitored, and it changes, a decision can be made to proceed or not proceed with the operation or activity.

As recommended by the National Academy of Engineering DWH study, require **Additional instrumentation**. Quit relying on indirect measures.

Consider the use of **Failure Modes & Effects Analysis**. In a FMEA, the ability to monitor and to check risk levels and margins is assessed. This can be factored into a Bow-Tie analysis, where risk levels and margins become much more evident and help in the overall risk evaluation.

Concerning **Risk Management**, it was noted that ISO, a multinational organization, has developed high level risk management guidelines (ISO 31,000) in multiple languages, and oil and gas management should adopt that terminology to be consistent in application, which will make it easier to communicate amongst countries using a terminology and taxonomy that is identifiable.

Incident and Near Miss Reporting

There was a suggestion to develop **Common reporting of near-misses**. These could be body-to-body incident definitions, etc. Recommend that the International Regulators Forum undertake or resume work on this. It may already be part of the **Common International Incident Reporting Requirements** initiative.

“Delta Arctic”

A question was asked: “What is best for the Arctic?”

- BAT (Best Available Technology) and BAST (Best Appropriate and Safest Technology), is one more appropriate for the Arctic? This might be more of a technology issue.
- Risk Analyses vs Hazards Analyses. What are the differences are there gaps?
- Performance-based and Prescriptive systems. Which is appropriate, when and where, in the Arctic?
- Audit guidance—such as audit techniques. There are gradational systems and there are Pass-Fail systems. Is the continuous improvement approach better to address deficiencies instead of issuing Citations and Incidents of Non-Compliance? From Pass-Fail, to a grading scale, to continuous improvement, to enforcement, is there one or the other that is better for the Arctic?
- Indicators and reporting. Leading, lagging, near-miss, is there anything better than others for the Arctic?

International Standards

It was noted that there are increasing calls for **International standards in the Arctic for offshore operations**. The Inuit Circumpolar Council Declaration on Resources says that international standards setting bodies must seek secure direct and meaningful input from Inuit. Maybe the Arctic Council is the appropriate place to raise this again.

Role of the PAME HSE Project in the Arctic Council

There was a suggestion that the outcome of the HSE Workshop should be a report back to the Arctic Council and point out the consistencies and the inconsistencies, and the numerous gaps in processes. Different terminology exists. The **Task Force on Oil Spill Preparedness and Response** should have the information from this HSE Workshop—especially for preparedness.

Capping and Containment

It was determined that the issue of **Capping and Containment** is not covered in the Preparedness and Response Task Force nor in EPPR. A suggestion was made that **Capping or Containment Stack requirements** be made BAST in the Arctic and that API RP 73W may be a template. A standard technique that nations would agree on and is a good contingency for an exploratory well drilled offshore in the Arctic. Is that something that regulatory bodies think should be required? It was pointed out that it would be relatively easy in the Arctic, because there are less well head designs to accommodate. It was also pointed out that there is a need for **Sharing Capping and Containment equipment**. How many facilities do you try to support at a given time? It is not necessarily an international issue, but a national regulator issue and their responsibility to let everyone know where this equipment is, and the feasibility and the time it would take going from point A to point B.

Workshop Conclusion

At the conclusion of the June 10, 2012 PAME Health Safety and Environmental Management workshop, it was decided that:

- The AOOGG 2009 has ample guidance for HSE Management Systems and Best Practices for offshore oil and gas operations for preventing a major systems failure accident in the Arctic.
- The AOOGG 2009 should be supplemented with additional guidance on HSE Management Systems and Safety Culture in an Arctic Context.
- A Safety Culture Workshop should be held in association with the PAME II 2012 Meeting.
- The HSE Management Systems Report should concentrate on only a few select major recommendations or guidelines so that they have a better chance at being considered.

Emergency Prevention, Preparedness, and Response Working Group Recommended Practices for Prevention of Pollution Project²⁰

RP3 Workshop June 11-12, 2012 Keflavik, Iceland

Monday, 11 June 2012

- Opening remarks and roundtable moderated by Co-Chairs Ole Kristian Bjerkemo (Norway) and Michel Chenier (Canada)
- The RP3 project-background, status and the way forward by RP3 co-chairs
- The PAME HSE-project – output from workshop by Dennis Thurston, PAME
- The Draft RP3 report by Morten Mejlaender-Larsen, DNV
- Break-out groups; Oil and Gas, Shipping, 3 Land-Based Activities, and Maritime Surveillance and Monitoring

Tuesday, 12 June 2012

- Break-out groups continues
- Group presentation and discussion; Group 1, Maritime Surveillance and Monitoring
- Group presentation and discussion; Group 2, Shipping
- Group presentation and discussion; Group 3, Land based
- **Group presentation and discussion; Group 4, O&G**
- Conclusions and future work

Summary of the Workshop²¹

The RP3 project is co-chaired by Michel Chenier from Canada and Ole Kristian Bjerkemo of Norway. Mr. Chenier gave a presentation on the project that included an update from the RP3 workshop, information on the project background, the current status and the proposed way forward. To prepare EPPR on the status of the RP3 project, the co-chair had also prepared an information document which was submitted to the participants prior to the meeting.

The workshop held June 11-12 in Keflavik successfully brought together experts to discuss the draft RP3 report, develop new information, and chart a path forward. The workshop enjoyed broad participation from all Arctic Council member states different authorities, industry and observers.

The objective of the workshop was to identify and develop information in the four major topical areas for the RP3 project: Oil and Gas, Land-based activities, Arctic

²⁰ This report and recommendations is due to the Ministers May 15, 2013.

²¹ <http://www.arctic-council.org/eppr/final-report-from-the-eppr-working-group-meeting-in-keflavik-iceland/>

shipping and Maritime Surveillance. As an important basis for the discussions, a draft report prepared by the contracted consultant DnV, was circulated prior to the workshop. The report will be revised based on the results from the workshop and circulated for further comments. The 3rd.draft report will be submitted to EPPR for review at the end of August 2012.

The output from the RP3 Workshop was an important issue for the EPPR meeting. Based on the discussion on the results of the workshop, EPPR discussed the way forward and how the final report should be developed. It was proposed to issue two products: a thorough technical report and a shorter high level overview document of perhaps 10-12 pages containing recommendations for the Ministerial meeting. EPPR will discuss the final draft report in the fall meeting.

Summary of the Oil and Gas Break-out Group of the BP3/HSE Workshops June 11, 2012

The workshop was led by Micele Chenier the RP3 project co-lead for EPPR and featured a discussion with the project contractor Morten Mejlaender-Larsen of DnV on the items in the Questionnaire circulated by DnV before the meetings.

The discussion centered on oil spill risk associated with unique characteristics of Arctic operations and what best practices might be used to mitigate the increase in risk.

What is different in operations in the Arctic (Δ Arctic) and what increase in risk is associated with that difference?

Δ Arctic = \uparrow Risk?

Risk of system integrity issues leading to accidental release (pipelines and drilling installations)

as a result of:

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

\uparrow Probability

environmental effects on personnel

- communication challenges
- Timing/seasonal pressures
- Ice and icing + temperatures result in unique design considerations
 - Equipment and instrumentation
 - Scouring
 - Permafrost trapping gas

- Leak detection
- Burying of pipelines
- Cementing

↑ **Consequence**

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

Δ Arctic = ↑ **Risk**

Necessitates:

- **Increased oversight**
- **Increased redundancies**
- **Special focus on:**
 - Implementation, ongoing review and corrective action processes included in safety management systems
 - Safety Culture
 - Certain HSE elements

Increased rigor in oversight and redundancies are required due to increased risks, un-tested equipment, challenges with operation of remote operated vehicles.

The balance between prescriptive/performance based regulation will shift as operations move into the Arctic. There will be a greater reliance on the “safety case approach” as operations move north. There will be a greater reliance on goal-setting and performance simply because of the lack of experience in the Arctic offshore. The focus should be on prescribing processes and establishing objectives, as opposed to prescribing technological and design considerations

To develop and maintain a safety culture it must be known how companies define and measure it. What drives safety culture?

- Indicators. Especially leading indicators are used to measure and identify trends.
- Incentivize: Performance tied to safety. There should be a balance of safety versus financial goals, especially at top management levels. Management must have a consistent message concerning safety.
- Ability to think the unthinkable

HSE Elements

Special focus on *certain* HSE elements

- Hazard Assessment
- Training and competence
- Accountability
- Operating Procedures
- Quality Assurance/Mechanical Integrity
- Management of Change

Hazard Assessment

Near-miss data becomes particularly important given the lack of experience for all operators in the offshore Arctic. It is important for ongoing risk analysis to have all instances reported.

Training and Competence for Arctic

- -mechanical
- -psychological
- -operational

It was noted that communication is different in the Arctic in some respects and that Arctic conditions could affect decision-making processes. It was also noted that there is a great turnover of experienced people affecting competency and increasing the training needs.

Accountability

- -Define who is responsible at all times for critical decision-making processes.
- -Standard communication processes do not necessarily transfer to the Arctic.

Operating Procedures

The Arctic presents unique and formidable challenges to operations and the procedures standard in other regions may not be adequate or appropriate to Arctic conditions. The misuse, poorly applied, or absence of proper operating practices is a common factor in many offshore accidents and should be a focus of the industry and regulators in the Arctic.

Quality Assurance/Mechanical Integrity

Due to the harsh and remote operating environment in the Arctic, it is critical that all equipment is monitored and maintained and that all components are certified by the manufacturer and properly used by the operator.

Management of Change

A factor in many systems-failure accidents, management of change is vitally important in Arctic operations where communications may be difficult and personnel are under work pressure in a short drilling season.

End of EPPR/PAME Oil and Gas Breakout of the RPP3 Workshop

About the Speakers for the PAME June 10 HSE Workshop

The Honorable Donald C. Winter is Professor of Engineering Practice at the University of Michigan. He served as the 74th Secretary of the Navy from January 2006 to March 2009. Previously, Dr. Winter held multiple positions in the aerospace and defense industry as a systems engineer, program manager and corporate executive. Dr. Winter received a doctorate in physics from the University of Michigan in 1972. He was elected a member of the National Academy of Engineering in 2002, and is currently the chair of the NAE committee investigating the Deepwater Horizon incident for the Secretary of the Interior.

Mr. Magne Ognedal holds a degree in BSC in Mechanical and Electrical Engineering.

His early experience is from automation of ship engine rooms and in automation of industrial processes.

He started work for the Norwegian Petroleum Directorate from 1974 as engineer. In 1980 he became Director for Safety and Working Environment Division, dealing with all aspects within safety and working environment for Norwegian offshore petroleum installations.

1st January 2004 Magne Ognedal was appointed Director General for the new Petroleum Safety Authority Norway, dealing with safety and working environment offshore and named facilities onshore.

Cathy Foerster earned a mechanical engineering degree with highest honors from the University of Texas in 1977. Upon graduation she worked for Exxon Company USA. She left Exxon in 1979 to work for ARCO, where she held a variety of engineering, operations, and management positions until ARCO was acquired by BP in 2000. She worked for BP for 1-1/2 years before leaving to work as an engineering consultant. In 2005 the Governor of Alaska appointed her to serve as the engineering commissioner for the Alaska Oil and Gas Conservation Commission. She currently serves as chair of the commission.

Céline Sirois has a Master's degree in Biology and fifteen years of experience in environmental assessment and regulatory strategy in the oil and gas and agricultural sectors in Canada.

Céline is currently the Technical Leader, Environment at the National Energy Board where she provides project management and stakeholder engagement expertise for regulatory change initiatives. She recently led the design and delivery of the public engagement portion of the Canadian Arctic Offshore Drilling Review, and is now leading the implementation of commitments made during that inquiry.

Before joining the National Energy Board, Céline was an Environmental Advisor with Agriculture Canada where she provided policy advice on environmental assessment for projects on agricultural lands, environmental stewardship programming and development of the Canadian Biofuel Industry.

Prior to this, Céline worked as a Professional Biologist with an environmental consulting firm in Calgary, providing wildlife, plant, and environmental reclamation services for the upstream oil and gas sector in Western Canada.

Mr. Joseph R. Levine earned a Bachelor of Science degree in Petroleum Engineering from the University of Wyoming in 1983. Since graduation, he has been employed as an engineer in various capacities with the Bureau of Safety and Environmental Enforcement (BSEE), formerly MMS.

He has served as a staff engineer in the agencies Alaska and Pacific offices, as a drilling engineer in Texas, and in various management positions in BSEE's headquarters office in Virginia including Senior Engineer with the Office of Offshore Regulatory Programs where he worked in a variety of areas dealing with offshore safety including; technical standards, industry training, SEMS, accident analysis, international activities, lifting safety and bonding. Prior to coming to work for the BSEE he was employed with oilfield service companies N.L. Bariod and Milchem.

Currently, he is Chief for the Emerging Technologies Branch. He is the BSEE representative on various API and ISO technical committees and is a member of the Society of Petroleum Engineers.

Attendees PAME HSE Workshop

Asmundsson	Johann	Iceland	PAME International Secretariat
Baker	Betsy	USA	Institute for Energy and the Environment, Vermont LS
Hesseldahl	Jens	Greenland	Institute for Energy and the Environment, Vermont LS
Campbell	John	UK	Bureau of Minerals and Petroleum
Einarsson	Kristinn	Iceland	National Energy Authority
Foerster	Catherine	USA	International Association of Oil & Gas Producers
Gudmundsdottir	Soffia	Iceland	PAME International Secretariat
Levine	Joseph	USA	National Energy Authority
Ognedal	Magne	Norway	Alaska Oil and Gas Conservation Commission
Palsdottir	Olga	Iceland	PAME International Secretariat
Petersen	Suni	Faroe Islands	Bureau of Safety and Environmental Enforcement
Spackman	Alan	USA	International Association of Drilling Contractors
Stedt	Bernt	Sweden	Swedish Coast Guard
Thomsen	Barbro	Norway	Climate and Pollution Agency
Thurston	Dennis	USA	Bureau of Ocean Energy Management
Sirois	Céline	Canada	National Energy Board
Snow	Norm	Canada	Inuvialuit Game Council
Pokiak	Frank	Canada	Inuvialuit Game Council ICC
Smith	Duane	Canada	ICC Canada
Winter	Donald	USA	University of Michigan

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