Supporting Document for the Arctic Council Offshore Oil and Gas Guidelines: Systems Safety Management and Safety Culture

# Findings and Recommendations of the HSE Management Systems and Safety Culture Workshops

This contains some of the findings and recommendations of the two offshore oil and gas workshops that were held in support of this project. The full reports with all presentations and discussions are published separately by PAME (PAME, 2013a[1] and 2013b[2]). These findings and recommendations are the opinions of experts and stakeholders at the workshops.

The first workshop was on HSE Management Systems held in Keflavik, Iceland during June 10-12, 2012. The second workshop was on Safety Culture and was held in Halifax, Nova Scotia, Canada, September 16, 2012. Both of these workshops convened international experts from governments, various industries, and academia, indigenous peoples organizations, and other Arctic stakeholders for full one-day presentations and discussions. Both workshops were well-attended by respected experts and stakeholders despite both being held on a Sunday.

Workshop participants were asked to consider particular issues for discussion, but were encouraged to contribute their expertise on any topic or subject they felt important. Therefore, the main themes covered in the workshops were determined to a large extent by the flow of the discussions.

The HSEMS Workshop discussed; 1) investigations of the DwH accident and lessons learned that relate to Arctic operations, 2) HSE management systems requirements of selected Arctic countries, 3) results of recent changes in Arctic regulatory regimes, and 4) in open session, various HSE elements that might need more focus in an Arctic context. The issue of safety culture was clearly identified as as a priority issue, and warranted a separate workshop to explore further.

The Safety Culture Workshop consisted of invited experts from various industries, government bodies, and academia who presented on the subject of "safety culture" as it applies to the prevention of systems/process failure accidents and pollution incidents.

The findings and recommendations from both workshops were combined because many common topics and issues were discussed in both. In addition, a separate summary of findings and recommendations from each workshop would result in doubling the length of this section and contains many redundancies.

The workshop findings and recommendations are arranged under common themes that were derived from the presentations or discussions at the workshops. The findings and recommendations do not necessarily follow the sequence they may have been presented in, nor from which workshop they came. They are also not attributed to any presenter or participant.

[1] http://www.pame.is/images/PAME_Ministerial_2013/HSE_Workshop_Report_10-12_June_2012.pdf
[2] http://www.pame.is/images/PAME_Ministerial_2013/Safety_Culture_Workshop_Report_16_Sep_2012.pdf

That information is contained in the workshop reports (PAME 2013a and 2013b). The two workshop reports were reviewed and the main findings and recommendations made by people in presentations or discussions were collected, summarized, and placed under common themes. Some themes were determined by the structure of the workshop presentations, while others came from discussions either after a presentation or in the open discussion sessions.

The information from these workshops is central to PAME for the findings and guidance in this report.

## HSE Management Systems Findings

### *Theme: Systems Safety*

**Low Probability High Risk events**
Major disasters such as the Deepwater Horizon incident are Low Probability High Risk events. These are rare and significant accidents that involve multiple workers or the public and often have far reaching environmental effects. They typically have complex causality related to unique system technology and/or design.

**Systems (or Process) Safety**
Systems Safety is related to complex systems or processes with many interactions and interdependencies.

- Cannot be adequately dealt with using outcome-based indicators because of the rarity of the outcome.
- Cannot be adequately dealt with using occupational safety statistics.
- Managing complex systems require a holistic approach using leading indicators that show how well the processes or systems are functioning.
- Requires access to all relevant data.
- Requires the ability to assess complex interactions.

**Balance or Tradeoffs**
Systems Safety involves tradeoffs that start with the well design and go through to well-completion. There are many uncertainties associated with the construction of a well, in particular, exploratory wells, such as geology, weather, well construction materials, and uncertainties in the way people behave when confronted with different situations. There are systems safety and efficiency trade-offs that have to made to achieve adequate margins of safety. Appropriate margins of safety need to be developed to deal with those uncertainties.

**Challenges**

- Ignorance.
- Arrogance.
- Complacency.
- Systems Safety measures and techniques are far more complex and expensive than occupational safety approach.

***The problem with Low Probability Events is very few experience them--those that did are either dead or retired.***

- It is hard to convince shareholders to spend the funds for preventing low probability events.
- Communication between operator and contractors is complex and there is limited sharing of data.
- Not taught to engineering students
- Not many engineering professors who have real experience
- Declining Budgets.
- Workforce Changes.
- Fraud.
- Short Memories: It is hard to change the mindset of the community without "Pinnacle Event."

**Process versus Implementation**

Implementation elements were factors in many accidents including the lack of communications, documentation and document control; operational control; management of change; and lack of adequate training.

***A common problem, is that a process is adopted but not implemented***

- The fundamentals of the system or program are not as important as *how* they are done.
- The degree of implementation of the process and degree of focus to assuring quality is what is important.
- The underpinning culture that supports that process is a key factor.

## *Theme: Risk Management*

***If there is no resiliency in the system, then there is little likelihood of being successful***

**Safety Margin Management establishes** margins of safety in the design phase.

**Bow-Tie Risk Analysis** allows a better assessment to be made of the ability to manage the overall risk.

**Monitor Risk** by monitoring changes in risk, allows decisions to be made to proceed or not proceed with the operation or activity. It changes the probability part of the risk equation.

**Additional instrumentation r**educes reliance on indirect measures and lowers risk.

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

PSA 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.

**The Arctic Offshore**

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

**Challenges**

- A basic problem dealing with the risk of low-probability, high-consequence events is convincing the shareholders to spend the money to prevent them.
- 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.
- Arctic Amplification of uncertainties, complexity, hazards, consequences, and overall risk.

**Δ Arctic = ↑ Risk?**

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

- **↑ Probability**
- **↑ Risk**

**↑ Probability**

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

**↑ Consequence**

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

## *Theme: Guidelines, Standards and Regulations*

Company, industry and regulator rules are rarely adequate because complex systems rarely exactly repeats a previous accident, therefore levels of detail are invariably inadequate to promulgate effective rules.

Attempts to provide systems safety by exhaustive rules lead to "affirmative defense" mentality

- Compliance with rules constitutes defensible action whether or not the system was safe
- Limits corporate and personal liability
- Psychology infects engineers, designers, workers, and regulators

The focus is on what governments and existing organizations like the IRF or new ones can do to improve safety and the environment. And recommendation on ways to create incentives for management systems and safety culture improvement.

**Common Standards**

- The wide diversity of operators as in the Gulf of Mexico makes it hard to standardize.

- If just the majors operate in the Arctic, there may be a reasonable chance of success in getting them together with the regulator and coming up with some agreed standards and practices.
- There are only 5 possible Arctic nations with offshore oil and gas activities, which also favors harmonization of standards or practices.
- Canada enforces standards that the operator has committed to applying in its approved plans, or where a standard has been incorporated by reference into a regulation.
- The US incorporates many industry standards in regulations by reference.
- Norway suggests standards and consents to standards that equal or exceed them.
- Russia and Norway are implementing new ISO standards in the Barents Sea (Barents 2020).
- Greenland has adopted and suggests the use of NORSOK standards.

The Inuit Circumpolar Council Declaration on Resources says that international standards setting bodies must seek secure direct and meaningful input from Inuit. The Arctic Council maybe the appropriate place to raise this again.

## *Theme: Regulatory Approach*

**Prescriptive and Performance-based**
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.

A Performance-Based, or Goal-Setting, Regulatory Approach places the responsibility and accountability on the operator. It is the favored approach for the Arctic offshore because there is too little experience to formulate a comprehensive prescriptive system and also because it allows flexibility to accommodate and incorporate possible rapid development of new technologies and practices.

- Prescriptive systems require an experience of activities to build a detailed understanding of all of the issues but the is lack of experience in the Arctic offshore to draw on for developing a comprehensive prescriptive regime.
- Prescriptive regulations for operations can limit the approaches and technologies best available to do the work safely in any given situation
- Performance-based (i.e. safety-case, outcome-based) regulations allow for innovations and timely use of better and safer new techniques and technology
- Performance-based systems place the responsibility and accountability completely on the operator.
- Prescriptive regulations may lead to an "affirmative defense" in an accident

**Inspectors Role**

- Having a presence on the rig does not provide much insight beyond occupational safety performance.

- From a systems safety perspective it is not as important to have an inspector on the rig as regulators looking at what is going in the well, which is critically important.
- Access to well and drilling data and the understanding of that data may be more important than an inspector being on the rig itself.

**Risk-Based Regulation**
In Canada, Norway, and Greenland, enforcement is based on the Continuous Improvement Cycle. This is a Tool for describing "risk-wise', how a company is doing. Companies must submit regular reports on development of risk indicators for incidents, accidents, release of gas etc.,

**Challenges**
There are challenges for the regulator 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

## *Theme: Lessons Learned*

- Typically, systems technology and applications are pushed until an accident occurs
- Investigations to determine cause and avoid repeating have a tendency to focus on identifying **the** direct cause.
- Time frames vary between major accidents within an industry or process--fifty years (and counting) for U.S. Nuclear submarines; two years for the U.S. Space Shuttle program; and less than eight months between the Montara and Macondo well blowouts.

***Complacency is the biggest threat to safety and everyone really needs to be aware of how to design the processes to fight against that every day.***

**Learning and Teaching**
- Teaching of systems safety in engineering schools is rare
- Guidance to operators on expectations is a teaching and learning experience
- There is an education and communication aspect to dealing especially with small and mid-sized companies to help show them how some of their own elements fit within the HSE expectations of the regulator.

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

**Challenges**
- Complacency
- Change is hard. There is often a lag in adoption of corrective measures.
- Learning peaks, and then erodes with time
    - Memories and personnel change

- Perception that changing technology obviates experience
- Hubris builds

## *Theme: Authority and Accountability/Responsibility*

**Responsibility:** A duty, obligation, or burden. The leadership is responsible for safety.

The Operator is responsible

- The operating company clearly has to have the overall responsibility for integrating the safety assessment.
- For systems safety, the operator is the only one who has the whole picture and access to all information available to make that safety assessment.

Industry is responsible for Barrier Management and Well Monitoring. The regulator needs information on risks and development of risks in the industry.

The operator is responsible for safe operations that do not harm the environment, and they are responsible for their Safety Culture and their HSE Management System.

***The complex managerial structure of Arctic frontier operations makes integrated systems safety harder to achieve.***

**Affirmative Defense,** claims no liability if rules were followed or plan was approved—putting the responsibility for safety and environmental protection on the regulator.

**Aviation Industry model**

- The responsibility for safety is in a general management safety organization who then reports independently to the General Manager.
- Individuals who are responsible for the schedule and delivery do not have to deal with the conflicting pressures.
- Mechanics are trained to have authority and accountability from the very beginning--if they are not willing to sign off on it, then they do not have to worry about being fired or reassigned.

**U.S. Navy system**

- The minute the Captain takes command they are responsible for everything on the vessel.
- If a ship goes aground, the commander is relived.
- The knowledge and understanding of the accountability pushes the behavior of those who command.
- It forces them to make immediate assessments of not only the physical condition of the vessels, but also capabilities and limitations of equipment.

**Incentives**

- Having people with authority actually signing certifications, management systems, etc., and accepting responsibility and accountability has value.

- Having personal accountability and refining that accountability through incentive programs and other factors is very important to motivating the behavior that a company wants.
- Accountability has to go through everyone who has potential to impact safety—from the drilling engineer to the tool pusher, to the mechanic, and all contractors.

Incentives for Safety Culture
- financial incentives and bonuses
- peer-pressure
- Soft signals, such as rewarding a "Stop," must be better implemented through the management system.

"Pay for Performance" incentives do not address safety.

Occupational safety indicators and performance appraisals are outcome-based, such as no-loss-work days and no accidents days. Because major accidents are rare outcomes, there is a need for the incentives to focus on the "process," or how the system is functioning.

**Contractors**
Operators and the contractors have to have very clear lines of responsibility and accountability. Bridging Agreements or Documents between contractors and the operators often serve this purpose and layout the operators requirements of the contractors.

Few regulators do enough to influence and oversee contractor behavior.

**Regulator**
Accountability for the regulator includes eliminating regulatory gaps and overlaps where possible and understanding shared responsibilities with other regulators.

It is the operator's responsibility to design and operate a well, and the regulators to review, audit, inspect, reject, consent, accept or approve the system design and operation—this includes the operators HSE Management System.

**Challenges**
- Standard communication processes do not necessarily transfer to the Arctic.
- The regulator needs to make sure it regulates and not operates, such as by dictating design.
- Corporations sometimes subvert safety culture
    - Using volunteers to get around refusal of unsafe work
    - People attain status and receive compensation for doing unsafe work
    - Authority and accountability are skewed toward getting the job done
- The petroleum industry is structured differently than the aviation or naval submarine industries.
- The petroleum industry has many layers in their operations, including contractors, subcontractors and sub-subcontractors.
- Cultural differences exist in different high-hazard operations.

## *Audit and Review*

Several HSE elements dealing with review and monitoring have been identified as common to many industrial accidents, they include:

- deficient inspections and monitoring;
- inadequate corrective and preventive actions to address identified deficiencies;
- poor records management
- poor internal audits, and
- lack of adequate management review.

PSA 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 requires an Acknowledgement of Compliance (AoC). The AoC is not an Approval. The AoC's cover all types of activity and may be required from the Rig Owner to the Drilling Contractor. 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.

Major Industry operators use an audit process that has multiple levels of assurance. For example, Shell Gulf of Mexico has:

- Corporate level – audits against company standards/policies, reports to Corporate Business Assurance Committee (BAC).
- Business level - audits against local standards /policies, including regulatory requirements.
- Local level - self-assessment against local standards /work procedures.

**Challenges**
Audit guidance is needed for countries adopting more performance-based oversight, such as audit techniques, use of gradational systems and the Pass-Fail approach and how they contribute to continuous improvement and enforcement.

## *Reporting*

Regular reports on the performance of the management system from the operator's responsible authority are essential for auditing and assessing the effectiveness of the system and it's continuous improvement.

The operator needs to have a policy and process for internal reporting of hazards.

In Canada applicants 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.

**Challenges**

- Reports on the management systems performance is inadequate or based on inadequate indicators or metrics.
- Processes of internal reporting of hazards are inadequate or not implemented.
- Near-miss process safety incidents often involve proprietary geological information or technology or techniques, and absent an accident, their details are not shared widely.
- Near-miss incident reporting requirements are not uniform nor well-defined by Arctic regulators.
- The proprietary nature of some near-miss incident data conflicts with transparency of the decisions made by the regulator.

## *Continuous Improvement*

Included as one of the four principles of the U.S. Safety and Environmental Management System requirement: “continuous improvement in the offshore industry's safety and environmental records;”

Elements critical to ensuring continual improvement within the system include:

- Inspection;
- Measurement and Monitoring;
- Corrective and Preventive Actions;
- Records Management;
- Internal Audits, and
- Implementation of follow-up measures

Continuous improvement of offshore performance requires actions from and cooperation between industry and regulators.

In the Arctic offshore, where there are many uncertainties and little experience to draw from, it is imperative that performance is improved on a continual basis by continually monitoring, assessing, and managing risk in these complex frontier operations.

For Industry continuous improvement should be integrated throughout the whole process--from Design to Decommissioning and include

- Risk Assessments and analysis
- Audits, reviews,
- Follow-up measures

For the Regulator continuous improvement is accomplished through

- Risk Based regulation
- Life Cycle Management
- Monitoring
- Inspections
- Enforcement

The process of continuous improvement is driven by data and the analysis of performance trends from that data.

**Challenges**
Cooperation between Regulator and Operator
Data is not always available or collected
Data is not analyzed for indentifying opportunities for improvement

## *Safety Culture*

Safety Culture relates to the Operator, but regulators have an important role in promoting a positive safety culture.

Safety culture and disasters

- 14 out of 17 disasters contained cultural causes
  - Tolerance of inadequate systems and resources (identified 10 times)
  - Normalization of deviance, (identified 9 times)
  - Complacency, (identified 8 times)
  - Work pressure/ cost (identified 4 times)

**Definitions of Safety Culture**

There are several similar definitions of Safety Culture. Definitions heard at the Workshop or made by Arctic States include:

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

Safety Culture is *"the shared values, norms and activities used by an organization to manage risk."*

*Safety culture is industry's leadership commitment and involvement in implementation of safety.*

*The BSEE defines safety culture as the core values and behaviors resulting from a collective commitment by leaders and individuals to*

***Safety cultures are hard to create but constitute irreplaceable avenues to systems safety.***

*emphasize safety, over competing goals, to ensure protection of people and the environment.*

*Culture: the shared values that exist within a particular organization*

*Culture determines the extent to which you live your systems.*

*Culture is what you do when no one tells you what to do.*

Other statements on Safety Culture from the workshop:

*A company never "gets" a safety culture. It is a continuous process of improvement and always needs work. "It's not a destination, it's a journey."*

*An effective safety culture establishes the priorities for safety vs cost & schedule trades*

*Safety and influencing safety are bigger than the industry, but safety culture is not.*

**Attributes of a positive Safety Culture**

- Safety is part of everything
- Consistent leadership behaviours
- Open and honest communication
- Common goals
- People are professional and learning is valued
- Standardized practices
- Consistent rules which apply to all parties
- Standardized metrics
- Rigorous assurance processes in place

A characteristic of a positive safety culture is a pattern of thinking, feeling, and behaving that emphasizes safety, particularly in goal conflict situations (*e.g*., production, schedule, and the cost of the effort versus safety).

**Effective Safety Culture**

- An effective safety culture establishes the priorities for safety vs cost & schedule tradeoffs
- Tradeoffs need to be conducted from drilling engineer to tool pusher and from preparation to bid on lease to completion of well
- Safety priorities and expectations must be clearly stated and communicated to all and management behavior and communication must be consistent at all levels and all times
- All actions by management must be consistent such as assignments, promotions, compensation etc
- Starts with CEO priorities and compensation incentives and goes through all levels of management

**Six Dimensions of Safety Culture** (Mark Fleming, St. Mary's, Halifax)

***Leadership for safety is clear:***

- Managers take every opportunity to demonstrate their commitment to safety.
- Leaders across the organization are actively involved in safety and act as role models for others.
- Leadership skills are actively developed

***Safety is integrated into everything:***

- Safety is an approach to doing things rather than an activity; therefore it is part of all activities.
- An operation or task is only a success if completed safely.
- Factors that influence performance, such as motivation, are acknowledged to influence safety outcomes

***Accountability for safety is clear:***

- There are clear lines of authority for safety
- Everyone is aware of their specific tasks and responsibilities.
- Everyone feels ownership for safety within their span of control.
- The independent and distinct role of the regulator is understood and respected

***Resilience:*** People should not "tolerate inadequate systems."

- In a positive safety culture, employees are encouraged to develop a questioning attitude.
- Employees are supported and rewarded for raising safety concerns or challenging management decisions
- Diverse workforce
- Teams contain team members with different backgrounds and skills

***Safety is learning driven:***

- Striving for continuous improvement.
- Learning drives improvement.
- Actively seeking out lessons from operational experience and conducting self assessments.
- Seeking to understand both failure and success in order to improve.

An effective safety culture supports institutions that can materially contribute to systems safety such as:

- Independent Technical Authorities
- Real Time Operations Centers

**Indicators and Safety Culture**

- An operator depends on indicators for improvement and should include assessments of Safety Culture using things like safety records and other indicators.
- Information needs of the government to gauge an operator's qualifications or performance is not always the same as industry's.

- Government needs to know problems and a focus on near-term trends so that the problems can be addressed.
- The use of these types of indicators also helps the safety authorities by giving a picture of the quality of the operator and contractors.

**Audits and Reviews**
Audits for compliance of Safety Culture can include the way a company addressed known inadequacy of machinery, infrastructure, or resources by reviewing maintenance logs and concerns raised at safety meetings, etc., and the follow-up on these issues by the operator.

**Contractors Safety Culture and HSE**
- In the US (Norway, Canada, and Greenland), the government sets out the expectation that the operator is responsible for ensuring that all of the contractors meet the requirements.
- The U.S. SEMS requires a document (Bridging Agreement) that includes Safety Culture be signed between the operator and contractor.
- The further the activity is away from the operator, down into the subcontractors and sub-subcontractors level, the harder it is to audit and ensure contractors have a positive safety culture.
- Some contractors work simultaneously for different companies that have different standards.

Safety Culture can be treated the same way as HSE Management Systems, in that it is up to each company to define their system and process, and verify that they are complying with the regulations and meeting their own requirements defined in that system and process. The fundamentals of the Safety Culture system or process are not as important as *how* they are done. The degree of implementation of the process is what is important. This equally applies to the overall management system submitted by an operator.

***The process is important, but it is the degree to which it is implemented that matters and the degree of focus to assuring the quality of the process.***

**Challenges**
- Tolerance of inadequate systems and resources
- Normalization of deviance
- Complacency
- Work pressure/cost
- Poor metrics and indicators of safety culture
- It is hard to develop and improve a safety culture in a prescriptive, compliance mentality environment
- We need to be more critical about safety culture and do not automatically accept it as an undefined cause of all accidents—as the modern version of last century's "act of god" finding for accidents.

## *Partnerships*

Because an HSE Management System, including the elements of a safety culture, is set by the operator with guidance and enforcement from the regulator, a degree of cooperation and communication is necessary.

**Openness, Partnership, Cooperation**

- Meaningful and necessary interaction between Government and Industry (and labor) requires openness.
- Regulators can be both independent *and* supportive, much depends on whether they are there to catch and punish or to help foster a positive safety culture and system improvements.

Two US initiatives are promising

- the Center for Offshore Safety (API)
- the Department of Interior SEMS approach, which is based on caring more about the safety outcome than about the individual infractions, less about punishing and more about encouraging.

One of the four principal SEMS objectives in the U.S. is, collaborate with industry in efforts that promote the public interests of offshore worker safety and environmental protection.

**Challenges**

- There is an apparent conflict in the regulator having independence and establishing a three-way partnership between management, government, and labor.
- It requires regulators to be competent. But industry gets most competent people.
- This is more of a challenge for industry to be open and cooperative.
- This openness and cooperation are culturally easier to achieve in Norway than elsewhere.

## *Proprietary Data and Near Miss Reporting*

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.

To foster collective learning, and to regulate, near miss data is needed as leading indicators to reveal trends. Not just accident and worst-case-scenarios.

Oil and gas operations have reduced incident frequency. But numbers of blowouts are so rare as to not be a statistically valid sample to establish trends in safety performance.

The International Regulators Forum had an initiative for Common International Incident Reporting Requirements, and may be a logical place to develop near-miss reporting definitions and requirements.

OGP maintains an anonymous database of near-misses that tracks occupational safety related incidents and are working to compile well-control incident database.

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. It was suggested U.S. Federal Aviation Administration-type reporting could serve as a possible template for reporting near-misses.

**Challenges**
This data is not usually public.
There is a hesitation in industry to share data, other than occupational safety data.
Transparency as a regulator is difficult when critical, safety related, data is held proprietary.

### *Capping and Containment*

**Capping and Containment** is not covered in the Preparedness and Response Task Force nor in EPPR.

Capping and Containment equipment or processes are not, at present, required by regulation in the Arctic. In the U.S. Arctic, capping and containment requirements are currently included in the operators approved Exploration Plan.

### *Arctic Offshore Oil and Gas Guidelines*

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.

## HSE Management Systems Recommendations

### *Management Systems*

- The focus of the regulator should be on prescribing processes and establishing objectives, as opposed to prescribing technological and design considerations.
- Establish standards for what the regulator expects that everyone must meet.
- Establish criteria for what expectation the regulator has that the operator and contractors will be able to meet the standards.
- Establish what the expected standards are for competency.
- Industry and regulators should foster an effective safety culture though consistent training, adherence to principles of human factors, system safety, and continued measurement through leading indicators.
- Require operators to develop a comprehensive ‘safety case’ as part of their exploration and production plans’ for certain high-risk areas including the Arctic.

- Develop more detailed requirements for incident reporting and data concerning offshore incidents and 'near misses' and make it publicly available.
- Assign individual civil and criminal liability for corporate leaders for certifying their management systems.
- Consider establishing an independent "Tech Authority" that is separate and independent from operator/regulator that focus on reviewing and approving any variances from procedures or specifications.
- Address the need to drive the "critical view" of the HSE Management System to the lower levels, down the contractor/subcontractor chain, by developing clear, consistent procedures

## *Managing Risk*

[Some factors on how companies manage risk are within government's control. These recommendations are meant to be "influencive"]

Regulators and industry need not just look at occupational accident statistics, but should focus on assessing *major risk* with the use of risk analysis techniques.

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

Risk in the Arctic

**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

- Require Safety Margin Management--margins of safety are established in the design phase.
- Use Bow-Tie Risk Analysis--a better assessment can be made of the ability to manage the overall risk.
- Require Monitoring of Risk by monitoring changes in risk, a decision can be made to proceed or not proceed with the operation or activity. It changes the probability part of the risk equation.
- Require Additional Instrumentation—do not rely on indirect measures.
- Consider use of Failure Modes & Effects Analysis which assesses the ability to monitor and to check risk levels and margins. This can be factored into a Bow-Tie analysis, where risk levels and margins become much more evident and help in the overall risk evaluation.
- The multi-lingual ISO 31,000 High Level Risk Management Guidelines should be used for common terminology and communications.
- Require integrated risk assessment and analysis for the whole operation

## *Auditing/Review*

Develop and share HSE Management Systems performance indicators.

Share trend analyses to enhance the assessment of major risk in the industry.

Conduct audits on a risk-based prioritization schedule and use the results to address improvement opportunities in the management system and safety culture.

Consider establishing an independent Safety Institute that develops and enforces industry standards.

**Real Time Monitoring**
Require real time operations centers. Government regulators should be involved in real-time monitoring at major points in the operations—such as negative pressure tests and other critical operations. The regulator should be knowledgeable and trained in the operations being monitored.

## *Accountability*

Require operators to assign and identify persons responsible and accountable at all times for critical decision-making processes including the HSE Management System.

Assign individual civil and criminal liability for corporate leaders for certifying their management systems.

Require people with authority to accept responsibility and accountability by signing off on certifications, management systems, etc.

Require contractors to have an HSE Management Systems or clear lines of responsibility defined in a bridging document.

## *Qualifications*

The case-by-case approach on evaluating an operators qualifications and performance used in other parts of the offshore should be replaced with a stated expectation and standards that everyone must meet. The Arctic is different—only companies that meet performance, financial, and technical qualifications should be allowed to drill.

The safety record of the whole company should be an indicator of performance.

Decisions on who qualifies for a lease should factor in the financial capabilities to pay for an effective response

## *Reporting*
Require the use and mandatory reporting of near-miss data as an indicator of safety culture.

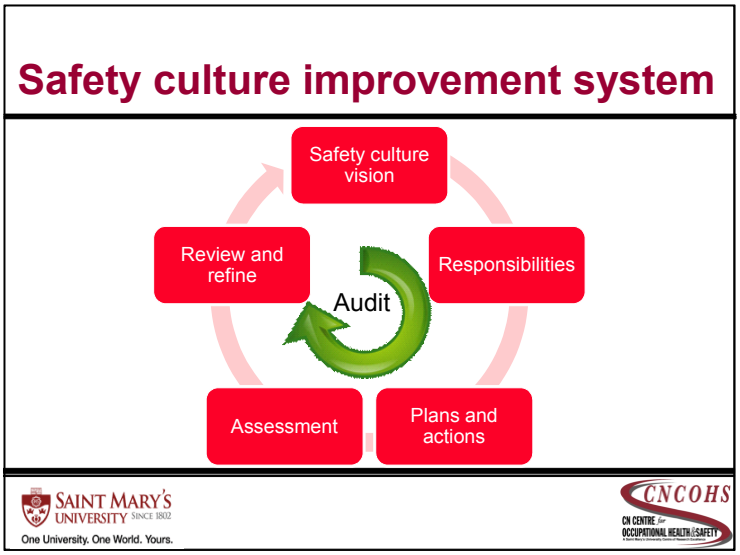
Develop protection for whistleblowers

## *Safety Culture*

*"Safety Culture*: The oil and gas industry must adopt a "culture of safety" as a collective responsibility with a focused commitment to constant improvement and zero failure rate and set up mechanisms to implement it.

Disaster prevention

- Do not think of Safety Culture as an "Optional Extra"
- Do not deceive yourself
- Adopt a systematic approach




Model of a Safety Culture Improvement System, from Mark Fleming, St. Mary's University, Halifax

**Define Safety Culture**

- An organization should pick a definition that fits their culture and stick with it to avoid ambiguity, or use of it in an ambiguous way.
- To improve safety culture it has to be defined and stated what they mean by safety culture in their organization.
- Other things may be done in the organization to improve safety, but if they fall outside of the definition of safety culture then they are not part of safety culture.

Rather than defining it as an outcome, find a process for an organization to put in place a consistent policy for safety culture that:

- Says the organization has a safety culture and defines it,
- Has a process to support and improve Safety Culture, and
- Has a solid methodology to actually assess the extent that they are really doing what they say they are doing.

**Audits, Assessments and Metrics**

Indicators
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.

Management should review asset integrity and process safety performance metrics on a regular basis

- Sr/Executive Management – Quarterly
- Operations/Line Management – Weekly/Monthly
- Field Supervision – Daily/Weekly

Performance metrics should contain a good mix of leading and lagging indicators

- Leading: alarm rates, PM/CM schedule compliance, overdue MoCs, Near Misses
- Lagging: Hydrocarbon spills, Recordable accidents, fires

**Incentives for Safety Culture**

**How to embed a meaningful and sustainable safety culture?**
By internally and externally influencing corporate decision-making. Ways to achieve this include:
**Incentives and disincentives** (Cost, profit, penalties, insurance, loss, performance programs, bonus structures, and non-financial rewards such as promotion and recognition)

- "Pay for Performance" incentives (using lagging indicators) do not address process or systems safety.
- Focus on "process" and how the system is working as a focus on incentives (using leading indicators)
- Use a performance-reward and process-oriented bonus reward basis, where the extent to which the leaders are meeting expectations they set for themselves is rewarded.
- Soft signals, such as rewarding a "Stop", must be better implemented through the management system.
- To incentivize system safety consideration by the shareholders, the profit could be tied to performance, or CEO pay tied to safety.
- New laws with "claw back" provisions, where previous bonuses get pulled back.
- Management could develop and institute "0 and 1" decision factors or "Go/No Go" decision thresholds for major incidents.
- Assign individual civil and criminal liability for corporate leaders for certifying their management systems.

**People** (Leadership, training, peer pressure, culture)

- Establishing incentives and protections for whistleblowers can influence a positive safety culture.
- Require corporate management to sign off on and be accountable for the management system.
- All actions by management must be consistent (assignments, promotions, compensation etc.)
- Safety priorities and expectations must be clearly stated and communicated to all
- Management behavior and communication must be consistent at all levels and all times

**Information** (Data analysis, disclosure, comparison, continuous improvement)

The offshore oil and gas industry should focus on process performance (leading) indicators, rather than just outcome-based performance to account for, and avoid, low-probability, high-consequence outcomes.

**Regulation** (effective, constructive, independent enforcement to assure attention to risk management: accountability)

- Assess and Monitor more robustly.
- Eliminate regulatory complexity.

***Inspect, Regulate, Monitor Performance, Improve Performance, and Penalize.***

Regulators should be well-compensated professionals and have the flexibility in hiring and retaining professionals that not only have the expertise but also the respect of, and the opportunity to engage with, their industry partners instead of the traditional adversarial inspector check-box inspection mentality.

- Compensate key regulatory staff adequately
- Insulate key regulators from politics
- Keep regulatory staff technically trained
- Ensure adequate/stable resourcing for regulatory oversight and a need for increased competence/independence.
- Establish fees as dedicated source of funding for regulators
- Significantly expand the formal education and training of regulatory personnel engaged in offshore drilling roles.

**Openness, Partnership, Cooperation**

*"Paid Informants" an alternative model for interaction between Regulators and Operators:* Government employment of rig workers one day a week to provide the regulator with real-time, first-hand information on safety performance on that rig

- Could provide valuable feedback on how safety is managed, and insight into challenges facing the operation.
- A process to improve meaningful interaction and promote safety culture development

*Independent Role Examiner Approach*

- A critical feature for non-chartered engineers such as Petroleum Engineers in the United States. Both independent and competent
- Follow the construction of the well, not just the approval at the beginning.
- Independence is guarded very carefully.

**Safety Culture Improvement System** Mark Fleming St. Mary's University, Halifax

A company never "gets" a safety culture. It is a continuous process of improvement and always needs work.

***Safety Culture Vision:***

- States the desire to continuously strive to improve the safety culture in pursuit of perfection
- May include a definition of a positive (ideal) safety culture

***Responsibilities and Accountability:***:

- Defines responsibility and accountability for key groups in creating and maintaining a positive safety culture
  - Managers
  - Supervisors
  - Contractor management
  - Non managerial staff
- Presents a safety culture framework

***Plans and Actions*:**

- Review current practices (e.g. using safety culture improvement tool)
- Sets short and long term safety culture improvement objectives
- Specifies processes to promote a positive safety culture
- Links with other aspects of the SMS (e.g. training, incident reporting)

***Assessment:*** The Assessment element should be broken into two main categories.

- Episodic (biannual)
  - Multi method safety culture assessment (e.g. questionnaire, interviews, document review)
- Continuous
  - Safety culture metrics
    - Capturing the markers left by safety culture on daily operations (e.g. the quality of safety reports)

***Review and Refine:***

- Review
  - Safety culture assessment
  - Audit
  - Other safety performance information (e.g. incident reviews)
  - External (e.g. research, other organisations)
- Refine safety culture management system

***Audit***: Very similar to other stand-off processes.

- Assessing the implementation of safety culture improvement processes:
  - Compliance with specified plan (e.g. leadership training plan)
- Assessing the effectiveness of the processes
  - Extent to which process met desired objective (e.g. change leader behaviour)

## *Capping and Containment*

The oil and gas industry should have containment technologies immediately available.

**Sharing Capping and Containment equipment**. Need for sharing and availability. How many facilities do you try to support at a given time? 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.

**Capping or Containment Stack requirements** could be made BAST in the Arctic (API RP 17W may be a template). A standard technique that nations would agree on and would be relatively easy in the Arctic, because there are less well head designs to accommodate.

## *Relief Wells*

Require back-up rig for relief well

Establishing standards up front for relief well capability is important due to the planning, cost, and availability of rigs.

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.

## *Proprietary Data and Near Miss Reporting*

Define "near-misses"

Incident/near-miss reporting should be public

Develop Common reporting of near-misses (i.e. IRF's Common International Incident Reporting Requirements initiative).

## *International Standards*

The President's Commission recommended there be one set of standards and requirements in Arctic offshore operations, covering

- design,
- construction,
- transportation,
- installation, and
- removal of offshore structures.

Barents 2020 has compiled and developed common standards for operations in both the Russian and Norwegian Barents sea and this could serve as a model or starting point for a wider discussion.

**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. AOGCC

*Global Best Practices*: The oil and gas industry should benchmark safety and environmental practice rules against recognized global best practices.