Safety Culture Workshop Report

Halifax, Nova Scotia, Canada, September 16, 2012

PAME
Protection of the Arctic Marine Environment

ARCTIC COUNCIL

Cover photo: Steel Drilling Caisson (SDC) Beaufort Sea, Alaska
Randy Howell U.S. Bureau of Safety and Environmental Enforcement.

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Workshop Report

Safety Culture

Arctic Council Protection of the Arctic Marine Environment Working Group

Halifax, Nova Scotia, Canada, September 16, 2012

The Arctic Council Protection of the Arctic Marine Environment Working Group (PAME) Safety Culture Workshop was conceived as a result of the discussions and conclusions of the Health Safety and Environmental Management Systems (HSEMS) Workshop conducted June 10-12, 2012. The purpose of the workshop was to inform the PAME HSEMS Project on "safety culture" in the Arctic offshore oil and gas industry, which was identified as a fundamental issue for safe and environmentally sound operations at the HSEMS workshop.

The one-day workshop was held in conjunction with the PAME II 2012 Halifax Meeting September 16. It consisted of a group of invited experts and stakeholders and presentations from various industries and government bodies who provided information on the subject of "safety culture" as it applies to the prevention of systems/process failure accidents and pollution incidents. The group collectively discussed the implications of the presentations and other expert opinions for improving Arctic offshore operations and provided advice to the PAME HSEMS project group on recommendations to improve system/process safety.

The following preliminary questions were provided as a possible focus of the invited presentations and discussions.

Safety Culture

What is it?

- Not just Safety, also foundation of Environmental protection
- For process failure accidents, occupational indicators are not reliable
- "Culture is what you do when no one tells you to do it"
- A "black hole" that you can't see but can see evidence around it.
- From corporate board room to rig floor, operator to contractor.

How can it be instilled and implemented?

- Defined and incorporated in Health Safety and Environmental Management Systems
- Training
- Incentives
- On par with economic concerns in the company

How can it be measured/monitored/audited/verified?

- Performance measures, leading and lagging.
- Incentives ("Catch someone doing something good")

How can it be enforced/improved?

- Audits: in-house, third party, government
- Indicators: need to develop and/or standardize including "near-miss" definition and reporting requirements

What can we learn in the Arctic from the Deepwater Horizon and other offshore drilling accidents?

What can we learn in the Arctic oil and gas industry and regulatory community from other industries and activities such as Naval, Aviation and Nuclear?

What is the advice regarding Arctic offshore operations that can be given to regulators and policy makers?

Presentations[1]

Sunday September 16, convened and ran by Dennis Thurston BOEM for the United States.

The HSE Management Systems Project and Purpose of the Workshop
(Dennis Thurston, PAME HSE Management Systems project leader)

Lessons learned from the Deepwater Horizon Accident: what influences safety culture?
(Fran Ulmer, Chair U.S. Arctic Research Commission and Member of the National BP Oil Spill Commission)

Process and Systems Safety
(Donald Winter, University of Michigan, Lead Author of the National Academy of Engineering's Investigation into the Deepwater Horizon Accident).

U.S. Navy's Submarine Safety Culture
(David Duryea, RADM, NavSea)

Safety Culture in the Offshore Oil and Gas Industry-A Shell View
(Dwight Johnston, VP of Safety, Environment, and Sustainable Development for DeepWater, Shell)

Safety Culture and Leadership Improvement—Modern Day Alchemy
(Mark Fleming, Saint Mary's University).

[1] Found at: http://www.pame.is/safety-culture-2012

Summary of Discussions

Discussions ranged from common elements of Safety Culture in general, to specific enterprises such as the U.S. Nuclear Submarine program, to offshore oil and gas including the Deepwater Horizon incident, to Arctic specific operations and considerations. The presenters touched on Safety Culture from the point of view of the regulator, industry, and academia, and discussions with participants brought in the perspectives of Arctic indigenous people and NGOs. The discussions were engaging and informative and brought out some strong points, such as the necessity to define it, use leading not just lagging indicators to measure it, and to continuously improve it.

Presentation and Discussion

Highlights:

-Safety Culture is hard to create;

-Safety is not a priority, it is a value;

-Operators should always experience "Chronic Unease" to avoid complacency;

-We have to change the "business as usual" approach, especially in the Arctic.

-Industry and the regulators must work together to institute and maintain a safety culture.

-Agree to a definition of Safety Culture.

-Common "cultural" issues in the causes of major accidents are

- Tolerance of inadequate systems and resources,
- Normalization of deviance,
- Complacency, and
- Work pressure/cost.

-Risk Assessment:

- Assess risk "as you drill" because you learn as you go.
- The authorities, companies and industry guidance, standards and regulations are rarely adequate, so continuous risk assessments and process improvements are critical.
- Technology is generally pushed until an accident happens, so it is important to assess risks continuously and improve process safety performance.
- Learning from history is not easy, the learning peak erodes and complacency sets in.
- Lessons are lost or forgotten.
- Invest in determining causes of accidents and near misses and avoid.

-Responsibility:

- The Operator should always be responsible party because only they have the overall picture of the complex operations and systems.

- Affirmative defense—make the operator responsible by not approving their plans, but by holding them responsible for following them (as in Norway's system).

-Financial incentive and disincentives:

- Raise liability caps
- Tie safety and environmental performance to lease or license qualifications
- Tie safety and environmental performance to insurance
- Tie safety and environmental performance to management compensation such as by instituting "clawback" provisions for bonuses (using the USA Sarbanes/Oxley Act for financial institutions as an example).

-People:

- Leadership, training, peer pressure can shape culture.
- Shared values.
- Everyone feels ownership for safety.
- Employees are encouraged to a have questioning attitude

-Information:

- Data sharing, analysis, disclosure, and comparison are necessary.
- Continuous improvement should be based on the data and risk analysis and reviews and audits.
- Find a way around the "proprietary" nature of some information.

-Change the way Governments Regulate:

- Effective and constructive with independent enforcement to assure attention to risk management.
- Accountability—for the Operator and the Regulator.
- Whistle-Blower protection guarantees.
- Safety Record of the whole company should be an indicator of performance.
- Mandatory reporting and analysis of near-misses to identify trends before an accident happens.
- Consider special elements of Arctic work.
- Establish or promote international drilling standards.
- Consider establishing an independent Safety Institute that develops and enforces industry standards.
- Consider establishing an Independent Technical Authority to sign off on any deviations from agreed procedures.
- Institute required real time operations centers.

Summary of Presentations

Presentation: Fran Ulmer

(Commissioner of the U.S. Arctic Research Commission and Member of the Presidents Commission on the Deepwater Horizon Oil Spill)

The Importance of Safety Culture:

What lessons can be learned from Macondo?

President Obama created a commission to determine causes of the Deepwater Horizon disaster, evaluate the response, and advise the nation about how future energy exploration should take place responsibly.

The Deepwater Horizon disaster was both preventable and foreseeable. That it happened is the result of a shared failure that was years in the making. The Presidents Commission on the Deepwater Horizon Oil Spill (Commission) investigation[2] found significant errors and misjudgments by the three major oil drilling companies – BP, Halliburton and Transocean – that led to the disaster. These companies have a large presence in offshore oil and gas drilling throughout the world. Taken together, we have concluded that these mistakes amount to a significant failure of management.

Much has changed since the Macondo well blow-out. Industry has a new appreciation for the risks associated with offshore drilling, and, the federal government has initiated significant reforms about how it oversees it. The Commission applauds these developments but they are not enough[3].

Findings:

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

Key recommendations coming from Commission in final report:

1. Create a Centre for Offshore Safety (COS)
2. Overhaul the regulator, Minerals Management Service (MMS)
3. Develop new or revised Law: raise liability caps, increase and define financial responsibility, develop protection for whistleblowers
4. Incident/near-miss reporting should be public

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

[3] ASSESSING PROGRESS: Implementing the Recommendations of the National Oil Spill Commission. http://oscaction.org/

5. Ensure adequate/stable resourcing for regulatory oversight and a need for increased competence/independence.

Changing Business As Usual

Recommendations for Industry

- Safety Institute: The oil and gas industry should establish its own "Safety Institute," independent of the American Petroleum Institute, that develops and enforces industry standards of excellence.
- 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
- Global Best Practices: The oil and gas industry should benchmark safety and environmental practice rules against recognized global best practices.
- Containment: The oil and gas industry should have containment technologies immediately available.

Changing Laws

Recommendations for Congress relevant to the Arctic

- Significantly increase liability cap and financial responsibility requirements for industry
- Providing protection for "whistleblowers" for safety problems
- Establish fees as dedicated source of funding for regulators
- Provide full dedicated funding for R&D to improve Response and containment techniques

Advancing Safety:

Changing Government

Adequate, stable resources for regulatory oversight are essential, as are regulator competency and independence. New agency structures, better regulations, and more enforcement all depend upon adequate funding. During the past three decades, while offshore drilling dramatically expanded in the Gulf of Mexico's ever deeper waters, funding of U.S. Government oversight of industry did not keep up and fell increasingly behind.

The Commission recommends that Congress and the Administration provide adequate and predictable funding for regulatory oversight; that is essential for these reforms to be effective and to meet challenges of ensuring offshore safety and environmental protection. And the Commission recommends that budgets for the regulatory agencies should come directly from the companies that are being granted access to a publicly-owned resources, the taxpayer should not pay for these costs. For offshore energy, funding sources could include a regulatory fee on new and existing leases or an increase in the inspection fees already collected by the Department of the Interior.

Recommendations for Federal Agencies

- Assign offshore energy management responsibilities to 3 entities
  - An independent safety authority
  - A Leasing and Environmental Science Office
  - An Office of Natural Resources Revenue
- Promulgate improved regulations and interagency coordination
- Develop management system incorporating "safety case" approach
- Promote adoption of consistent international best practice standards
- Improve NEPA environmental reviews
  - Stronger interagency consultation (particularly with NOAA)
  - Implemented by Office of Environmental Science

Implementation of the Recommendations

The Oil Spill Commission Office will report yearly on the anniversary of the Deepwater Horizon incident as to responsiveness to recommendations. The 2011/12 Report Card:

Congress: **D** Avoiding an "F" only because they authorized some additional funding to BSEE. Congress has not acted on any other recommendation.

Regulators **B-** Considerable progress has been made but more interagency coordination between Interior, NOAA, and the Coast Guard—a lot of agreements but it is not seamless nor transparent. Progress has been made in the Safety and Environmental Management System (SEMS) program, but more needs to be done to move toward performance-based management systems.

Industry **C+** Progress on containment and creating the Center of Offshore Safety organization. It is of concern to the Commission that the COS is under the industry association API, which has lobbied against SEMS and stricter regulatory regimes that might help create a culture of safety. The Commission will evaluate the performance of the COS as it progresses. COS is a key ingredient in Safety Culture issues--it can dramatically advance this issue in the right direction, or it can lead to treading water.

Special Challenges in the Arctic

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

Recommendations for the Arctic

- Drilling must be done with the utmost care because of the sensitive Arctic environment
- An immediate, comprehensive research program to provide a foundation of scientific information is needed
- Industry and the Coast Guard should address gaps with respect to:
  - Oil-spill response
  - Containment
  - Search and rescue
- The U.S. should promote the development of international drilling standards for the Arctic

Many other entities have made similar recommendations

- BOEM/US Coast Guard Joint Investigation Team4
- International Association of Drilling Contractors
- International Regulators Forum5
- API/ Center for Offshore Safety (COS)
- U.S. Chemical Safety Board6
- Canada's National Energy Board
- Harvard 's Emmett Environmental Law and Policy Clinic7
- PEW, The Wilderness Society, Oceana, IDDRI Experts Workshop and many other conferences and workshops
- DOI's Ocean Energy Safety Advisory Committee[8]

How to embed a meaningful and sustainable safety culture?

By internally and externally influencing corporate decision-making. Ways to achieve this include:

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[4] Joint Investigation Team Reports http://www.bsee.gov/BSEE-Newsroom/Publications-Library/Joint-Investigation-Team-Report.aspx

[5] IRF http://irfoffshoresafety.com/

[6] U.S. Chemical Safety Board Investigation of Deepwater Horizon http://www.csb.gov/investigations/detail.aspx?SID=96

[7] Recommendations for Improved Oversight of Offshore Drilling Based on a Review of 40 Regulatory Regimes, 2012. Harvard Law School Emmett Environmental Law & Policy Clinic http://www.law.harvard.edu/academics/clinical/elpc/publications/offshore-drilling-white-paper_final.pdf

[8]Ocean Energy Safety Advisory Committee recommendations to BSEE May 2011 http://www.bsee.gov/uploadedFiles/BSEE/About_BSEE/Public_Engagement/Ocean_Energy_Safety_Advisory_Committee/OESC%20Recommendations%20August%202012%20Meeting%20Chairman%20Letter%20to%20BSEE%20101512.pdf

1. Financial incentives and disincentives (Cost, profit, penalties, insurance, loss, performance programs, bonus structures, and non-financial rewards such as promotion and recognition)
2. People (Leadership, training, peer pressure, culture)
3. Information (Data analysis, disclosure, comparison, continuous improvement)
4. Regulation (effective, constructive, independent enforcement to assure attention to risk management: accountability)
5. Three way partnership: (management, labor and government)

Discussion

Oil Spill Liability
A participant noted recommendations from Inuit Circumpolar Council and Denmark/Greenland for guaranteed funding of an effective response to an oil spill as a subject of an Arctic Council Oil Spill Liability agreement. They also noted that research needs to inform the insurance industry were identified in the recent report by Harvard, which pointing out the inadequacies of insurance for offshore oil and gas operations. The Commission, however, did not address the liability issue. Commissioner Ulmer personally felt that liability and funding mechanisms are not well-defined and lack the certainty of adequate funding, for not only cleanup and mobilizing, but for compensation to the local people who would be affected; this is handled differently from one country to another. Discussions on a shared funding mechanism for oil spill cleanup could include how to share the funding and what triggers it.

It was suggested that decisions on who qualifies for a lease should factor in the financial capabilities to pay for an effective response. In discussion, it was pointed out that in all likelihood only major companies with such financial capabilities will be able to afford to work in the Arctic offshore for the foreseeable future.

Another participant added there is also the timeliness of the response to consider. Liability deals with the long-term, after-the-fact aspects of a spill, but in the meantime, tremendous resources must be mobilized in an already complex situation compounded by unique Arctic operational challenges.

Incentives for Safety Culture
Concerning financial incentives and business methods, a participant asked if there are any developments in specialized individual incentives. According to Commissioner Ulmer, there are multiple ways to send signals to those in an organization that indicate what kind of behavior is good or bad. Certainly financial incentives and bonuses matter, as does peer-pressure. Soft signals, such as rewarding workers for calling a “Stop” when dangerous conditions are observed, must be better implemented through the management system.

A participant offered that they believed the basic structure of safety systems in industry are mostly adequate, but that they focus on occupational safety and are not addressing major systems failures and low probability-high consequence accidents. Pay for Performance" incentives do not address safety. Another participant pointed out that occupational safety indicators are outcomes, such as no-work-loss days, number of accidents, number of days without accidents, etc., and therefore, bonuses and performance appraisal systems are largely outcome-driven, rather than driven by process. As an outcome, low-probability events are rare; therefore the functioning of the system should also be a focus of financial incentives. Some progressive organizations use a more complex performance-reward basis where they look at the extent to which the leaders are meeting expectations they set for themselves, including process oriented bonus rewards. It was suggested that the offshore oil and gas industry focus on process performance (leading) indicators, rather than just outcome-based performance to account for, and avoid, low-probability, high-consequence outcome.

A commenter suggested that since the industry corporate structure is driven by, and responsible to, their shareholders, they have a basic problem when it comes to dealing with the risk of low-probability, high-consequence events. Most industries spend 10-20% for occupational safety, but if there is a 10% bonus incentive to drill the well on time, there will likely be little worry about a low-probability event that may happen once in a career. To incentivize system safety consideration by the shareholders, the bottom-line could be tied to performance, or CEO pay tied to safety. There could be new laws with "claw back" provisions, where previous bonuses get pulled back. Management could use multiplicative factors with "0 and 1", "Go/No Go" decision thresholds for major incidents.

A participant offered that stock market advisors are asking how to spot the "BPs." They want to know how to get assurances and what questions to ask the companies to feel confident in their performance.

Other factors besides financial issues affect behaviors, such as possible promotions or recognition.

Commissioner Ulmer noted that the Harvard Law School paper found that *"Requiring senior corporate officers to certify the management systems can be a powerful incentive for creating a culture of safety, especially if the certifying officer is subject to civil and criminal liability for false certification."* Therefore, in addition to financial incentives, in addition to creating a culture, in addition to good training, if there is actually have a tool such as individual civil and criminal liability for corporate leaders who have not actually provided the right information for certifying their management systems, and if the auditor or third-party certifying body determines that they are not doing it right, then that is a huge opportunity for instituting change. Some countries do have such systems in place, but not the U.S.. What is driving decisions

and accountability and what can and cannot be achieved? Having an external entity such as the Arctic Council say what good practices look like, what accountability looks like in other places, might allow us to make progress to these goals.

A commenter pointed out that different countries have different systems and cultures and thought that it is important to find the right balance between the linking good performance and bonuses and other incentives. They suggested that this could lead to a system where doing the right thing is because there is an expectancy of some kind of bonus or financial incentive. People should do the right thing because it is the right thing to do and making people think it is the right thing to do is part of this HSE project. It should be part of the culture instead of being driven by incentives.

Whistle Blowers

Establishing incentives and protections for whistleblowers can influence a positive safety culture.

HSE Management Systems Project

A participant noted that there seems to be a need for circumpolar guidance and we need to take what we have heard at the workshop from various industries and try to use that for Arctic offshore oil and gas operations and in a form that is useful to the Ministers and countries.

A commenter believed we still don't have a good feel for how the different countries systems work. There are overviews of current legislation in the HSE Project's Compilation Tables of HSE Elements for Comparison, but still no clear understanding of how each other's systems work. People have read about it but do not really understand it and in some discussions the basics have been skipped. There needs to be an understanding of how things are working, so that discussions can be had of what is common between countries and levels of convergence. Otherwise, this will end up something like the PAME Arctic Offshore Oil and Gas Guidelines, which are of limited use to some countries because their systems are much stricter than the suggested measures and are mandatory.

Presentation: Donald Winter

(University of Michigan, Lead Author of the National Academy of Engineering's Investigation into the Deepwater Horizon Accident)

Systems Safety

The subject of Systems Safety goes beyond the National Academy of Engineering investigation of the Deepwater Horizon (NAE Report[9]). Professor Winter expressed

[9] National Academy of Engineering– Analysis of Causes of Deepwater Horizon Explosion, Fire, and Oil Spill to Identify Measures to Prevent Similar Accidents in the Future http://www.nae.edu/Activities/20676/deepwater-horizon-analysis.aspx

that in his over 40-year tenure in the aerospace and defense industry, that from a safety perspective, he was only partially successful. He attended too many funerals of employees, service members, and bystanders who were killed as a result of accidents in his purview that should have been prevented. His experience gives him a unique perspective.

Systems Safety

Systems Safety versus Occupational Safety: Both systems safety and occupational safety attempt to avoid accidents – events with unplanned and unacceptable consequences. What is deemed to be acceptable, changes with the general culture over time. For example, 125 years ago in the U.S. Railroad industry, there were an average of 2000 fatalities a year just from coupling accidents. This was viewed as the responsibility of the workers—their bad behavior--and was deemed as acceptable by the Railroad industry. Obviously, that is not the case today and a company like that would be under intensive public investigation. In the same way that the value of human life and life of workers has changed radically over the last one hundred years, the acceptance of environmental damage is also rapidly changing. What used to be considered acceptable in the past is no longer acceptable.

Systems Safety concerns major accidents that involve multiple workers or the public, not "trips and falls" or lift accidents, but low-probability, high-consequence events. They are not well-predicted by occupational safety statistics and there is a lot of excellent academic research that analyzes this, the Chemical Safety Board Report[10] goes into this in great detail. An organization can have exceptional occupational safety statistics, yet still be subject to major system safety accidents.

Systems Safety accidents typically are very complex in their causality. When charting the direct and "contributing causes" and their systemic effects, it is evident how this all builds, such as in the case of the Deepwater Horizon, where there were a multiplicity of factors that led to that event. They all tend to be related to unique system technologies or design or a combination those.

- Low-probability, high-consequence events
- Not well predicted by occupational safety statistics
- Typically have complex causality related to unique system technology and/or design

Systems Safety is Hard to Manage: Managing Systems Safety is not easy. Complex systems require a holistic approach to management. This is not an issue of having a single component fail because it was used outside of its intended regime or because it was manufactured improperly. In many cases subsystem interactions dominate in

[10] http://www.csb.gov/investigations/detail.aspx?SID=96

accidents, with or without component failures. The totality of the system and system design has to be viewed in order to understand whether or not an appropriately safe condition exists.

The safety measures and techniques for Systems Safety are a lot more complicated and they are lot more expensive. It is not a question of furnishing hardhats or steel-toed shoes to employees. An Emergency Operations Plan (EOP) is very expensive. Adding a cement squeeze after a negative pressure test is an expensive and time consuming activity. Systems Safety has to be seen from a very complex perspective A worker can understand problems and risk associated with lift accidents based on their own experience and understanding. They also understand that stopping a lift has minimal impact on operations. But dealing with complexities of drilling operations, especially at great depths, workers cannot be expected to understand or deal with many of these issues, such as what the drilling log means, what the geology is, pressure gradients, and pore-pressures. The rig workers cannot be expected to integrate and understand all of this information and data. Only the operator has this overview and capability.

The structure of the oil and gas industry with multiple contractors and service companies, makes it very difficult to have a systems perspective. Industry generally likes this approach because they do not have to employ all of the people or own the all of the equipment themselves, making for a more efficient use of capital. Legally, it spreads out the liability, but that is in direct conflict with needs of systems safety. Workers, drilling and other contractors, and their employees do not have access to all of the data. Only the operating company has access to all of the relevant data. The NAE believes strongly in the approach of the Norwegian Petroleum Safety Authority, which is to hold the operating company responsible for overall systems safety.

The petroleum industry seems more concerned with proprietary data than any other industry in the experience of Professor Winter. Even within the operating company. In a visit to BP Headquarters by the NAE Committee, they were told about each individual activity because each of the 12 individual joint venture partners, weren't allowed to share the data. It really complicates their operations process. Understanding of what is considered proprietary creates inherent challenges (even within an operating company) in facilitating the collective learning that needs to occur.

- Complex systems require a holistic approach
  - Subsystem interactions often dominate safety considerations
  - Off nominal conditions can cause accidents w or w/o component failure
- Safety measures and techniques far more complex and expensive than occupational safety approach
- Most systems safety issues not accessible to workers

- Requires access to all relevant data and
- Ability to assess complex interactions

- Structure of Offshore Oil and Gas industry complicates systems view
  - Dependency on drilling and service companies
  - Limited dissemination of data

Systems Safety is about Tradeoffs: These trade-offs occur all of the time. It starts with the well design and goes through to well-completion. There are many, many uncertainties associated with the construction of a well, in particular, exploratory wells. There are uncertainties with the geology, weather, well construction materials, and uncertainties in the way people behave when confronted with different situations. Appropriate margins of safety need to be developed to deal with those uncertainties. And the risk needs to be assessed in all aspects and reassessed as construction proceeds, because as drilling proceeds the operator is learning and understanding more about the geology, the fracture gradient, and pore pressures. On the Deepwater Horizon, who on the rig really understood what was going on with the pressure reversals? Why was pore pressure and fracture gradient reducing as they drilled deeper? And what did that mean about the margins of safety and the potential for a kick, or worse, was about to occur? There are trade-offs, and anyone who denies it is denying reality. There are systems safety and efficiency trade-offs that have to made to achieve adequate margins of safety.

- Starts with design and goes through well completion
- Must accommodate uncertainties
  - Geology, weather, materials, human factors etc
  - Development of margins of safety against total system risk
  - Risk must be assessed considering all elements of design and construction program
  - Risk must be reassessed as construction proceeds
- Inherent, material tradeoffs between systems safety and efficiency (cost and schedule) e.g.
  - Cost of BoP
  - Schedule impact of cement “squeeze”

Learning from History is Hard

This is not only about the oil and gas industry, it is a generality. Technology is generally pushed until something happens and when it does, investigations are carried out with great intentions, like the Deepwater Horizon, which identify causes, but take time. However, people want immediate reaction because of the belief that “some thing must have happened” to cause the accident. In the immediate aftermath of the Deepwater Horizon disaster it was the Blowout Preventer, or some other piece of equipment that was to blame, and it was hoped that if it was fixed, everything will be OK. Psychology supports that reaction. But to build a case of what really happened, it

takes a long time because change is hard, it is time consuming and it is expensive. Eventually, the learning curve peaks, things are fixed, as well as they can be, and then the learning erodes with time. It is too early to demonstrate this for the Deepwater Horizon accident, but it is clear from other examples. Why does this happen? Some people forget, some people change out or retire, or there is a belief that new technology will prevent it from happening anymore. And hubris builds. In the NAE Hearings, testimony from many in industry expressed confidence in their operations because they had drilled 7000 wells in the Gulf of Mexico and this is the first time this ever happened. It happened. And analytically it can be figured out what 7000 successful wells says about their failure. The time-frame or learning erosion period varies a lot.

A short time period example is the 1972 DC 10 door failure, followed two years later by a Turkish Airways Dc 10 door failure. Sometimes it takes longer. A long time period example is the 1912 Sinking of the Titanic and almost exactly 100 years later, the grounding of the Costa Concordia. The similarity of factors is striking. They were going too fast for conditions, there were basic flaws in naval architecture design, there were inadequate life saving equipment and boats.

- Typically, systems technology and applications are pushed until an accident occurs
- Investigated to determine cause and avoid repeat
    - Tendency to focus on identifying the direct cause
    - Lag in adoption of corrective measures – change is hard
- Learning peaks and then erodes w/ time
    - Memories and personnel change
    - Perception that changing technology obviates experience
    - Hubris builds
- Time frames vary
    - DC-10 cargo door: AA 96 (6/72) to TK 981 (3/74)
    - Titanic (4/1912) to Costa Concordia (1/2012)

Guidelines, Standards and Regulations

So what can be done? In part, regulations can be added. Regulations are an ever increasing product of government and industry. These are not just government regulations, but also regulations internal to corporations and industry. Unfortunately, it does not always work because these are complex systems events. They are not caused by a very specific component. They very rarely repeat previous accidents. Therefore, excruciating detail can go into the analysis of a certain activity, but fixing all of those specific areas may or may not have an impact on the next event. Invariably, the level of detail in government regulations is not adequate because of the interaction of the various subsystems. It is hard to guarantee that any amount of regulation is going to cover all eventualities.

- Company, industry and regulator rules are rarely adequate
  - Complex systems rarely repeat a previous accident exactly
  - Levels of detail are invariably inadequate

An issue related to prescriptive regulations is so-called "compliance mentality." In the United States there is the concept of "Affirmative Defense" that tends to settle in, which is a legal term that says that, "If I comply with all of the regulations, I can't be held liable for the consequences." It is defensible. Corporate lawyers like this because they know exactly what must be done to protect the company's liability. But, this compliance mentality also affects everybody. Engineers that are involved in very risky areas like to know what they need to do to make things safe. They do not like being told by their managers that they have to go and "work the problem" themselves make sure they have dealt with all aspects of the problem to ensure it is safe. It is not easy.

- Attempts to provide systems safety by exhaustive rules lead to "affirmative defense" mentality
  - Compliance with rules constitutes defensible action whether or not system was safe
  - Limits corporate and personal liability
  - Psychology infects engineers, designers, workers, regulators

Safety Culture

An alternate to increasing regulations is to develop an appropriate Safety Culture. A definition of culture: ***It's what you do when no one tells you what to do***. It is what to do when there is no regulation, it is what to do when the supervisor does not tell them to do it this way or that way. It is done because it is the right thing to do and part of the company's culture.

An effective Safety Culture establishes the priority for the trade-offs that are invariably going to establish the margins of safety for any activity. Companies before the NEA Commission often testified that they never compromise safety, absolutely never compromise safety. This testimony was rejected. The only way to make sure safety is not compromised is by not doing anything. The minute it is decided to spud a well, safety is starting to be compromised. The question is can it be done in a way to minimize the probability that anything significant is going to happen. Often people say about trade-offs, that it is a simple cost-benefit analysis. Grant it, the consequences are huge, but that can just be figured into the cost-benefit analysis. But the fact is, that it is really hard to establish either the probability that one of these events is going to occur, or what the consequences are going to be. Is there anybody that believes before Deepwater Horizon they could have estimated the cost of that event?

Another point is that Safety Culture is something that encompasses everybody. This is not something that can be handed to a Safety Organization that sits off on the side and establishes rules and regulations. Everybody from the drilling engineer to the tool-pusher has to understand, because everybody is involved in the trade-offs. And it starts when a company is getting ready to bid for a lease or apply for a license. As the development of the well proceeds from design to drilling, the operator is learning more and making decisions. In the Macondo well, the temporary abandonment procedure changed many times. There is nothing wrong with changes. The operator should be able to change those processes when needed, as they are running. But they have to be mindful of what they are doing in a total risk sense—what they are doing to the overall margins of safety.

- Culture is what you do when no one tells you what to do
- An effective safety culture establishes the priorities for safety vs cost & schedule trades
    - Those who claim safety is never compromised forget that the only way to achieve that is to do nothing
    - Hard to analytically justify cost to avoid low probability high consequence events
- Tradeoffs need to be conducted by many
    - From drilling engineer to tool pusher
    - From preparation to bid on lease to completion of well

Safety Culture "Musts-Haves": The priorities and expectations must be stated clearly and in a way that can be communicated to everyone. It must be consistent. PSA has a brochure they put out on Safety Culture[11], which has an example of interviews done with workers on a rig that said a corporate executive came on site, gave a 5-minute speech about the importance of safety and then spent the rest of the time asking only about the productivity of the rig—how many feet they had drilled etc. What type of message does that convey? It becomes very clear where the priority is. Management cannot just simply give an award to an employee for an occupation safety issue, like stopping the lift, or wearing hardhats, and then put pressure on their productivity and efficiency. In particular, industry cannot continue to talk to the investment communities about how they are going to materially reduce the cost of exploration and production, without ever talking about safety—and believe that it will not affect the negative sense of Safety Culture in their organization.

Actions have to be consistent, people have to be assigned, promoted, and compensated for the right things. As mentioned in the discussion after Commissioner

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[11] PSA: HSE and Culture
http://www.ptil.no/getfile.php/z%20Konvertert/Products%20and%20services/Publications/Dokumenter/hesculturenyny.pdf

Ulmer's presentation about CEO priorities and compensation, Professor Winter noted that he has been a CEO and has been subject to this type of compensation. In his company, they established a 0/1 multiplier for conduct. Responsible individuals for components, evaluating logs, or ethics considerations, were not allowed to use factors, such as a 10% factor before the trigger is pulled, it is a 0/1 multiplier. This makes it clear that the Board is serious about doing the right thing. There are now "claw-back" provisions for various financial irregularities. It is possible to have these for Safety as well. The financial rules like Sarbanes/Oxley have the preferred accountability phraseology of "*Known or Should Have Known*" versus the old "To the Best of My Knowledge and Belief." This makes the CEO spend more time and attention on the disclosure documents.

- 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
  - Cannot ignore the inherent conflicts with efficiency
- All actions by management must be consistent
  - Assignments, promotions, compensation etc
  - Rewards for occupational safety do not offset undue pressures for cost and schedule performance
- Starts with CEO priorities and compensation incentives and goes through all levels of management
  - Typical management incentive programs don't work
  - Need zero/0ne multiplier or claw back provisions

Effective Safety Cultures: An effective safety culture supports thoughtful tradeoffs of safety, cost and schedule throughout the design and implementation of complex systems. In an effective safety culture, margins of safety are sustained and timely and proper decisions are made.

An effective Safety Culture can also reinforce organization structures that support the improvement of systems safety. Independent Technical Authorities, an approach used in the U.S. Navy is a group of people who are separately distinct from those responsible for coast and schedule who must approve certain changes. An Independent Technical Authority is a huge tool. Another tool for improving Safety Culture and systems safety is Real-Time Operations Centers, Shell clearly believes in R-TOCs. It is recognized that there is dispute--some companies believe in them, other companies do not want somebody looking over their shoulders possibly interfering with critical decisions on the rig. But there are good indications that these can provide significant improvements, including strengthening of Safety Culture.

- An effective safety culture supports institutions that can materially contribute to systems safety e.g.
  - Independent Technical Authorities
  - Real Time Operations Centers

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

Discussion

Teaching Systems Safety

In response to question on how he teaches systems safety, Professor Winter noted that it takes an entire term and it is done with a large number of case studies from a wide variety of industries. It is taught to Naval Architects, Mechanical and Environmental engineers. Most engineering students are shocked, because they do not even know the history of their chosen industry, whether it is Civil Engineering or Ship Building (although some have heard of the Titanic). They are taken through a number of examples from the aircraft industry, the Space Shuttle accidents of Columbia and Challenger—another example of lessons forgotten, hubris building, the refusal to confront and understand the limitations of the way in which the organization was run. When the students complete the course they really do get an understanding that systems safety is important. He believes they listen to him, at least in part because in his capacity in the Navy and Defense industry he has lost real people. Unfortunately, in most Universities there are not many people who have real experience, which is part of the reason why the Professor of Engineering Practices concept was adopted by University of Michigan.

Roles of Regulator, Industry and Labor- Collective Learning

A participant highlighted the challenge or apparent conflict of implementing both Recommendations #4 and #5 for regulators, of the NAE Report; Number 4 being for the regulator to have independence and Number 5 being establishing a three-way partnership between management, government, and labor.

In reply, it was noted that although not easy to do, regulators can be both independent *and* supportive. It is related to the role of the regulator. Are they just there to catch somebody doing something wrong or bad, to inspect how many fire extinguishers are at any given level on the rig? Or, is the objective of the regulator to help foster and develop a safety culture? It has a lot to do with attitude. It requires regulators to be competent. However, qualified and knowledgeable people are attracted to industry jobs with much higher compensation. In the U.S. there are ways to increase salaries for special positions, but Professor Winter felt that the U.S. Civil Service Commission cannot support the development and employment of a regulator cadre that is appropriate to this particular problem.

It was pointed out that the Presidents Commission on the Deepwater Horizon Oil Spill recommended that the regulators have well-compensated professionals in these positions 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 check-box inspection mentality. A direction the U.S. seems to moving in.

The Norwegian Model-Openness, Partnership, Cooperation

It was noted that the Deepwater Horizon Commission report concluded that openness contributes to information exchange and learning, creates credibility, and lays the basis for cooperation between companies and government as seen in the Norwegian Government approach to the oil and gas industry. It was acknowledged however, that this may be hard to achieve in the United States because of differences in National culture. Historically, there is an antagonistic relationship between industry and government and less of a sense partnership in the U.S. It was posed that it may be more likely for Canada to be able to follow the "Norwegian" model with openness to partnering than it would be in the political culture in the United States. Political rhetoric such as, "all regulations are bad," "there are too many regulations," "industry is to blame," and "industry is just about profits," does not support the kind of long-term cooperative "Norwegian approach." Some current efforts have potential or promise, such as the Center for Offshore Safety, if it actually moves in the right direction, and 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.

Another Model for Interaction between Regulators and Operators

A participant proposed a process to improve meaningful interaction and promote safety culture development through 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, which could provide valuable feedback on how safety is managed, and insight into challenges facing the operation. This proposal was acknowledged as not being probable due to industry's general reluctance to a partnership approach with the regulator. This participant had seen more examples of the regulators reaching out to support industry, than industry supporting the regulator. This is more of a challenge for industry

Independent Role Examiner Approach

Professor Winter suggested an independent role examiner approach, as another alternative way to support the competency of the regulator. It is a critical feature for non-chartered engineers such as Petroleum Engineers in the United States. The independent role examiners are both independent and competent and they follow the construction of the well, not just the approval at the beginning. Their independence is guarded very carefully.

Proprietary Data and Near Miss Reporting

A participant noted that part of being a credible regulator was to be transparent and that it was difficult to be transparent while dealing with an industry and a government (Canada) that keeps most exploration and production information proprietary. They asked how do we foster collective learning that needs to happen from, not just the case studies of worst-case scenarios, but important near-miss incident information that is required in regulations but, at the same time, considered to be proprietary?

Inspectors Role

A participant asked if it would help to have regulators on the rig all the time? And do the inspectors have the knowledge to stop operations if there are bad practices? Professor Winter noted that there was concern in the Deepwater Horizon investigation that there was a lack total understanding amongst the regulators of what was going on. Having a presence on the rig does not provide a lot of insight beyond occupational safety perspective. The regulator needs to worry about a lot more than just evidence of what is on the rig. From a systems safety perspective it is not as important to have an inspector on the rig as regulators looking at what is going on below, in the well, which is critically important. Access to that data and the understanding of that data is as important if not more important than being on the rig itself.

Accountability

A participant noted that from the presentations they were still left wondering who is responsible. Who's eventually responsible for safety? Professor Winter stated that everyone is responsible. But the operating company clearly has to have the overall responsibility for integrating the safety assessment. For systems safety, they are the only ones who have the whole picture and access to all information available to make that assessment. So this means the company has to be responsible, the management has to be responsible, and clearly the people who work on the rig and the supporting organization have to be responsible. There needs to be an inversion of that corporate responsibility, personal responsibility and accountability that will cause people to act in an appropriate manner.

It was noted that at the HSE workshop in Keflavik, there was discussion about the U.S. Navy approach to accountability, where, except in very rare circumstances, if a ship goes aground, the commander is relived. It does not matter whether the commander was on the bridge, it does not matter whether they had command for 12 months or for 6 hours. The minute they take command they are responsible for everything on the vessel. That knowledge and understanding of the accountability pushes the behavior of those who command. It forces them to make immediate assessments of not only the vessels physical condition, but also capabilities and limitations of equipment. So having that personal accountability and refining that accountability through incentive programs and other factors is very important to motivating the behavior that a company wants. And that has to go through all of the people who have potential to impact the safety—from the drilling engineer to the tool

pusher, to the mechanic. It would be a lot easier to say, "this is the person", but it is not that easy.

A comment was made that in industry there is a line of authorities involved in drilling a well, but that the ultimate accountability resides with the manager.

It was noted that in the aviation industry there is a tendency to take the responsibility out of the hands of the project or program manager, and give it to a general management safety organization who then reports independently to the General Manager to make sure that the individuals who are responsible for the schedule and delivery of particular products, such as aircraft parts, does not have to deal with the conflicting pressures—should they run another test? Should they make the modification? On the DC 10 the decision was made to not make the modification to the design of the door that subject to failure. Instead, they opted for placing detailed instructions for the ground crew in English and the country of origin language. The Turkish airline DC 10's door instruction could not be comprehended by the French ground crew in Paris and it led to a crash.

Lessons Forgotten

It was noted by a participant that the International Association of Oil and Gas Producers has 74 member countries and they promote safety culture through operational management systems. An observation from the discussions at this Workshop, is that there is talk about lessons to be learned but one of the striking facts is about lessons we forget. How do we stop that draining away?

Presentation: David Duryea

(Rear Admiral, Deputy Director for Undersea Warfare Naval Sea Systems Command)

The U.S. Navy's Submarine Safety Culture

NAVSEA oversees all submarine and ship design. There are four ship yards and warfare centers. The main work is oversight of contractors. Therefore, Admiral Durea represents the regulator for the submarine safety program. The SUBSAFE Program was created following the loss of USS Thresher in 1963 in which 112 officers and 17 civilians died.

The US Navy's Submarine Safety Culture

The purpose of the SUBSAFE Program is to provide "*maximum reasonable assurance"* of:

- Hull integrity to preclude flooding
- Operability and integrity of critical systems and components to **control** and **recover** from a flooding casualty

Responsibility: A duty, obligation, or burden. The leadership is responsible for safety.
Accountability: The state of being answerable for one's actions (implies consequences)
Integrity: Rigid adherence to a code of behavior

The fundamentals include:

- Work discipline (Knowledge of and Compliance with Requirements). NAVSEA has qualified and trained technicians who follow rigid and approved procedures, with oversight by supervisors and engineers. The procedures, engineering and drawings are non deviational. No changes can be approved by the program manager and must go back up the chain of command for decision by an impendent technical authority.
- Material control (Correct materials installed correctly)
- Documentation
    - Design Products (Specs, Drawings, Maintenance Standards, etc.)
    - Objective Quality Evidence (OQE)—a required signed piece of paper certifying that a specified type of material has been supplied for critical systems.
- Compliance verification (Inspections, Surveillance, Technical Reviews, Audits)
- Separation of powers (authorities)
- Continual training
- Non-deviation from specs, procedures, etc.

Two audit types are performed: certification audits after each submarine is constructed and functional audits of the facility's processes, procedures, policies every 2 years.

Compliance Verification

A multi-layered approach is used in the Compliance Verifications process involving

- Contractor/Shipyard/Activity responsibilities
    - Inspections, Surveillances, Document Reviews, Audits
- Local government oversight authority responsibilities
    - Inspections, Surveillances, Document Reviews, Audits
- Headquarters responsibilities
    - Document Reviews, Audits

A Multi-faceted approach is also used involving

- Ship Certification Audits
- Facility Functional Audits

SUBSAFE Certification Audits:

- Ship-Specific. The team audits records, and verify work, material, qualifications and certifications.
- A critical element for certification for sea trials and unrestricted operations

SUBSAFE Functional Audits:

- Facility-specific review done by a team led by a Submarine Flag Officer or Civilian Senior Executive from Headquarters and specialists from other facilities. Headquarters is also audited by a Navy team from outside of Headquarters. These audits cover
  - Policies
  - Procedures
  - Practices
- Verifies organizational compliance with SUBSAFE Program requirements

There are three grades given for five different areas in a Functional Audit; Pass, Fail, and Problems. The middle category usually requires some corrections and a new audit in a specific area after a period of six months to a year.

Controlling Work aboard US Navy Submarines

- Only Qualified and Authorized Firms work on submarines and DSS systems
- In 1996 heavy workloads created a capacity shortage among submarine yards
- NAVSEA established instructions to qualify a firm to do submarine work
- Focus of controls is on repair and maintenance work performed onboard the submarine, rather than components worked at suppliers facilities
- Suppliers of new material and Original Equipment Manufacturers are exempt
- Procurement process for these organizations ensures compliance
- Navy wide notice is issued annually listing authorized firms and yards
- A functional audit of each authorized activity is conducted every two years
- Firm remains on the list provided the audit results are satisfactory

Internal Audits

- NAVSEA Functional or Certification Audit, each activity conducts an internal audit to self identify and correct any problems
- Generally conducted in the off-year between Functional Audits.
- Allows them to gage their own knowledge, awareness, and compliance against future NAVSEA results
- Results are in turn audited in the Functional Audit

Oversight also includes self-assessments, internal audits, trouble reporting--significant problems are reported and “critiqued” for lessons learned using the “5 Why” approach.

Self Assessments

- Each activity prepares a self assessment annually to report how the activity grades itself on compliance with the program requirements.
- Includes metrics derived from internal and external audit results, problem reports and root cause analyses, and submarine test report deficiencies

Trouble Reporting

- Each activity is required to report significant problems to alert the community so that they can establish preventive actions before those problems might occur elsewhere
- The "5-Whys" analysis is used as an iterative investigation into causes. In almost every case, this type of analysis results in identification of root-causes.
- Underlying document is called a "critique" and includes a full analysis of the root causes and corrective/preventive actions taken to resolve them.

Why does the submarine Navy invest so much in compliance Verification?

- Because the consequences of failure are unacceptable.
- Because the pressures of cost and schedule are great.
- Because an honest mistake can kill you just as dead as malpractice.

"In God we trust, all others bring the OQE (the facts)"

Separation of Powers

This is a critical aspect of the program. Whether the construction of a new submarine or the maintenance of an existing sub. At the top in the diagram is the Program Manager who is responsible for delivery of the product and the cost and schedule. Also there is the Independent Technical Authority who are the engineers who have the final say. The Independent Technical Authority does not report to the Program Manager. And there is also the Independent Safety Quality Assurance Authority, and whose job is to verify that what the Program Manager delivers is what the Independent Technical Authority says it should be. These three work together to certify that a ship is safe to go to sea—and every single person must agree that it is safe.

Signatures and/or badge numbers must be legible, numbers for the specification on a bolt torque must be legible, if there is any ambiguity at all, the paperwork will be sent back to the shipyard for clarification. U.S. Navy's Submarine Safety Culture Continual

Training

All staff from entry level to 3 star generals attend SUBSAFE training annually. Annual training includes lesson learned. Everyone goes through annual training about the Thresher because no one wants to be part of the next one. Annual Training includes a written exam and is updated every year.

Training emphasizes not letting little problems happen. If the little problem are ignored, eventually there will be a bigger problem. For example; 7 bolts are needed in a joint even though 10 are used in the design. On inspection, one is found to be torqued wrong. It is investigated, even though it was completely safe with 9 good bolts. Because next time it could be 2 bolts, or 4 bolts with the wrong material and 2 torqued improperly, and eventually the joint fails. These lessons learned are pulled into the annual training.

Another key piece to SUBSAFE annual training is to bring in experts from other organizations. For example, slides 15-18, show some of the people that have spoken in the training.. Speakers from various industries are brought in to discuss system and engineering failures.

SUBSAFE, Defense Security Service, & FBW Awareness

- Training is required for all personnel, from entry level workers to 3-star Admiral
- Annual Requirement
- Must achieve passing score on associated exam
- Training provides:
    - Overview of the program and importance of program fundamentals
    - Reinforcement of compliance with requirements

- Emphasis on proactively correcting and preventing problems
- Recent lessons learned and a reminder of consequences of complacency

SUBSAFE staff are constantly out talking to all layers in the system about safety culture.

In addition staff get out to different places. Every time there is an event dealing with submarine maintenance, SUBSAFE staff are there talking about the program.

- NAVSEA's Senior Manager's Workshop
- NAVSEA's School Of The Boat
- MIT's Submarine Concept Design Course
- Audit Outbriefs include Senior Level Representatives
- Training materials available to Field Activities upon request
- Open offer to Field Activities to provide trainings and briefs

This is done to continually reinforce the Culture and the SUBSAFE program and why it is so important.

Challenges

What keeps the Admiral up at night? Ignorance, arrogance, and complacency. The U.S. Navy's Safety Program has a very successful history; however we must be aware of the program's greatest threats:

- **Ignorance** The state of not knowing
- **Arrogance** The habit of behaving based on pride, self-importance, conceit, or the assumption of intellectual superiority and the presumption of knowledge that is not supported by facts
- **Complacency** Satisfaction with one's accomplishments accompanied by a lack of awareness of actual dangers or deficiencies
- Declining Budgets
- Workforce Changes
- Fraud
- Short Memories
- Changing mindset of community without "Pinnacle Event"

It has been almost 50 years since the Thresher was lost and that is actually more frightening than if it happened a couple of years ago. He expressed the same worry as Dr. Winter mentioned, about the "Delta" in time after an incident. NASA had a 2-year time between Space Shuttle accidents; the Navy submarine force is now at 50 years. He worries about that mind-set; people don't understand, people don't remember, there is not that personal connection. They have not had a "pinnacle event" and that

is one of the reasons they go after all of the small issues--to understand what happened.

In these times of economic down turn and budget cuts, they are also seeing more fraud. Most of this is caught by the companies. These include things like falsifying records of the type of material used, and sometimes it is caught in the simplest way, white out on the documentation. These actions are criminal offenses.

Concluding Remarks:
Quotes from Admiral Rickover that capture where the Navy's culture is.

"Good ideas are not adopted automatically. They must be driven into practice with courageous patience."

"Once implemented they can be easily overturned or subverted through apathy or lack of follow-up…a continuous effort is required."

Discussion

Authority and Accountability
A participant noted that, there is value in having people actually signing certifications, management systems, etc., and accepting responsibility and accountability. They are less likely to take the word of someone else if they are accountable. Another participant noted that this works well for some individual countries and makes sense, but it is only in the environment where they have the authority and there is a difference between having the authority and having the freedom. There is a cultural piece here that may be different in different environments with high hazard operations such as the aviation industry where from the very beginning mechanics are trained to have authority and accountability. And if they are not willing to sign off on it, then they do not have to worry about being fired or reassigned.

Corporate Culture and Authority/Accountability
A participant commented that corporations sometimes subvert safety culture. For example, a worker has the right to refuse unsafe work, but companies get around this by asking for volunteers who then get status and compensation and it avoids the refusal to work clause. If one person will not sign off, they are perceived as not being very helpful and another person may be approached that is more willing to sign, a company player. Good organization and best practice do not always transfer in a hierarchical organization where authority and accountability are strongly skewed from the beginning toward getting the job done. This is something to keep in mind. They suggested that it may be different in the Navy where military workers have authority that may not exist in the oil and gas industry civilian workers. Admiral Durea noted that 95% of the people who work on the submarine program are civilians from a wide variety of specialties, but acknowledged that they do have authority. It is a cultural issue stemming from the Thresher accident. He also noted that if people have to sign

off, it has to be simple, i.e. it is either 40 +/– 2 foot-pounds or not. People are not being asked to sign for the design adequacy. For this level, it should be a simple yes or no.

Process versus Implementation

Concerning the fundamentals of the SUBSAFE program, it was noted by a participant that with the exception of Separation of Power, a senior executive at BP could have given the exact same description a day before the Macondo well blew out. A challenge to learning good practices is in describing the essence of what we do. The fundamentals described for SUBSAFE are not the essence of what is important—it is not *what* things are done, but *how* they are done. The degree to which the Navy investigates the minor events and the degree of implementation of the process is what is important--the underpinning culture that supports that process is a key factor. Many of the management systems look the same between one organization and another, but the way, and to the degree, they are implemented can be very different. What seems important from the Navy's SUBSAFE program is the degree to which those processes are implemented, not the processes themselves. An oil company executive could have shown almost exactly the same management system fundamentals as the Navy. But the key is the degree of focus to assuring the quality. The process is important, but it is the degree to which it is implemented that matters.

Balancing Financial and Social Responsibilities Motivations

Commenting on the points about private sector/industry and SUBSAFE's overarching goals, a participant noted that is where the role of the regulator is important to counterbalance to profit motivation. The oil and gas industry can never have complete self-regulation. There has to be legal compliance, in addition to the peer pressure and safety culture incentives, to counterbalance the financial imperative. The relationship between industry and government is an interesting contrast between Norway and the U.S. There is a higher cultural tolerance to the industry in Norway and because of the higher degree of social acceptance, there is a counterbalance in the "profit" and "social responsibility" motivations. From a political perspective, having regulation be more of a partnership with industry and labor is interesting and deserves more conversation in the international context.

Indicators and Safety Culture

A participant noted that the operator depends on indicators for improvement and should include assessments of Safety Culture using things like safety records and other indicators. This also helps the safety authorities. Knowledge that is appropriate from the government's perspective to gauge an operator's qualifications or performance is not always the same as industry's. It is not the materiality of one or ten thousand chains of events; it is the materiality of problems. This approach can lead to a focus on near-term trends so that the problems can be addressed. Another participant noted that the use of these type of indicators also gives a picture of the quality of the operator and contractors.

Presentation: Dwight Johnson
(Shell, VP Heath, Safety and Environment (HSE) – Deepwater)

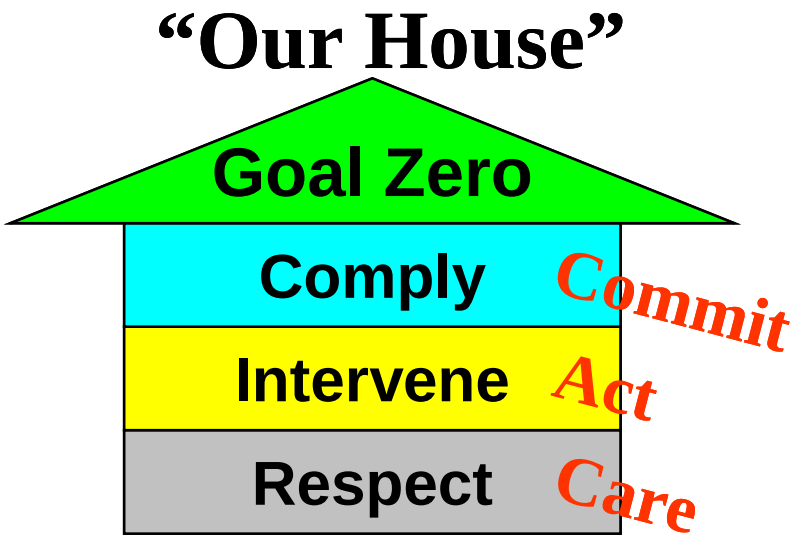
Safety Culture in the Offshore Oil and Gas Industry - A Shell View
The aim of the Shell Group's HSSE&SP Control Framework is to provide a single source

for the Group's expectations covering health, safety, security, the environment and social performance.

Shell Group's HSSE & SP Control Framework

- Applies to their Upstream, Downstream and Projects Businesses
- Includes Mandatory requirements
- Also includes guidance/reference information
- Each Shell Business is expected to implement the HSSE&SP Control Framework

Shells Safety Culture is based on three Golden Rules



Shell has adopted Goal Zero – no people hurt, no leaks

Safety Culture is grown with a Goal Zero mindset

HSE Management System Manual

The first priority of the HSSE Control Framework project has been to replace the over 55 Group Yellow Guides with mandatory Manuals. In 2008, the project team – with the support of a cross-business steering team and many subject matter experts and business testers – developed 35 manual sections and two specification documents which included almost all of the sections from the new HSSE Management System Manual, sections from the Personal Safety Manual, Transport Manual – including the mandatory Driver Safety and Professional Driver Safety manual sections – as well as other sections from the Manuals.

- Competence manual section and specification
- Emergency Response
- Incident Investigation and Learning
- Impact Assessment
- Joint Venture HSSE Requirements
- Leadership and Commitment
- Management of Change
- Management Review
- Managing Risk
- Organisation, Responsibilities and Resources
- Performance Monitoring and Reporting manual section and specification
- Permit to Work
- Planning and Procedures
- Policy and Objectives
- Risk Assessment Matrix

Process Safety

The need to make a good distinction between personal and process safety was a result of BP Texas City explosion and fire.

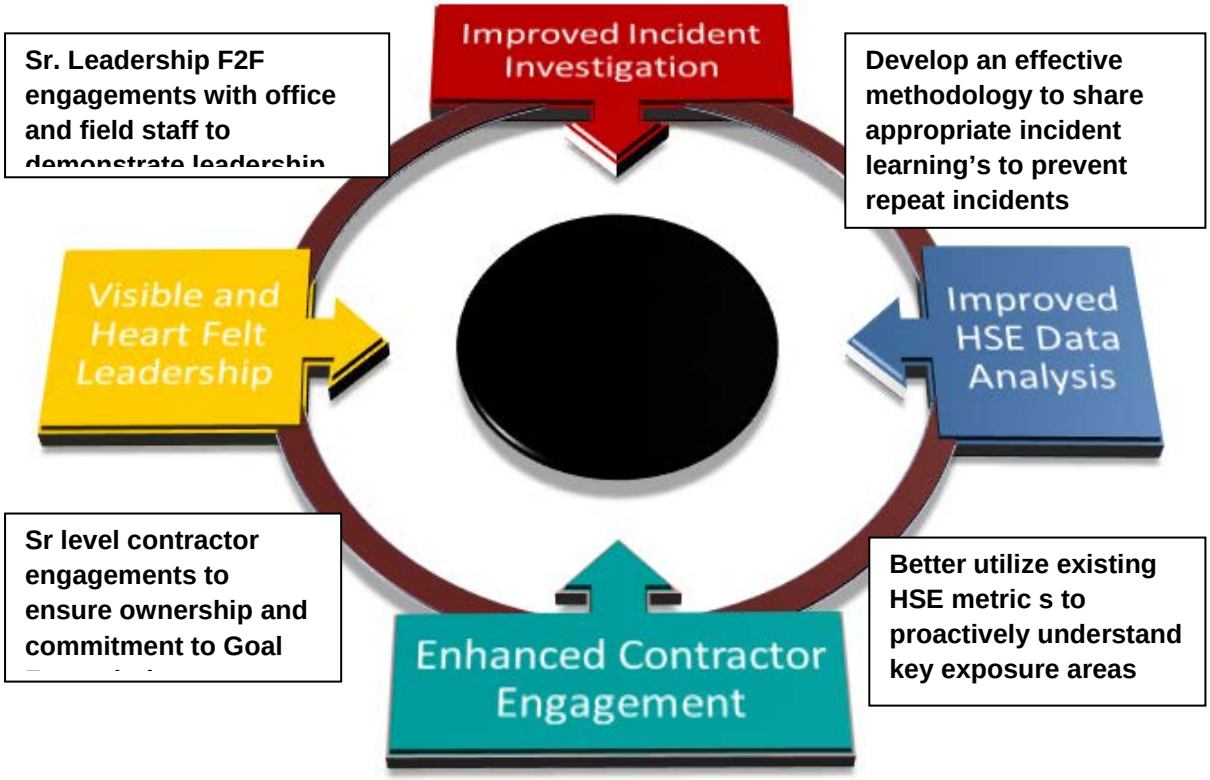
- Asset Integrity and Process Safety management (AIPSM) Application Manual, AIPSM Standards Transition Manual, DEM1, DEM2. Overrides

"Chronic unease" is a product of behaviors.

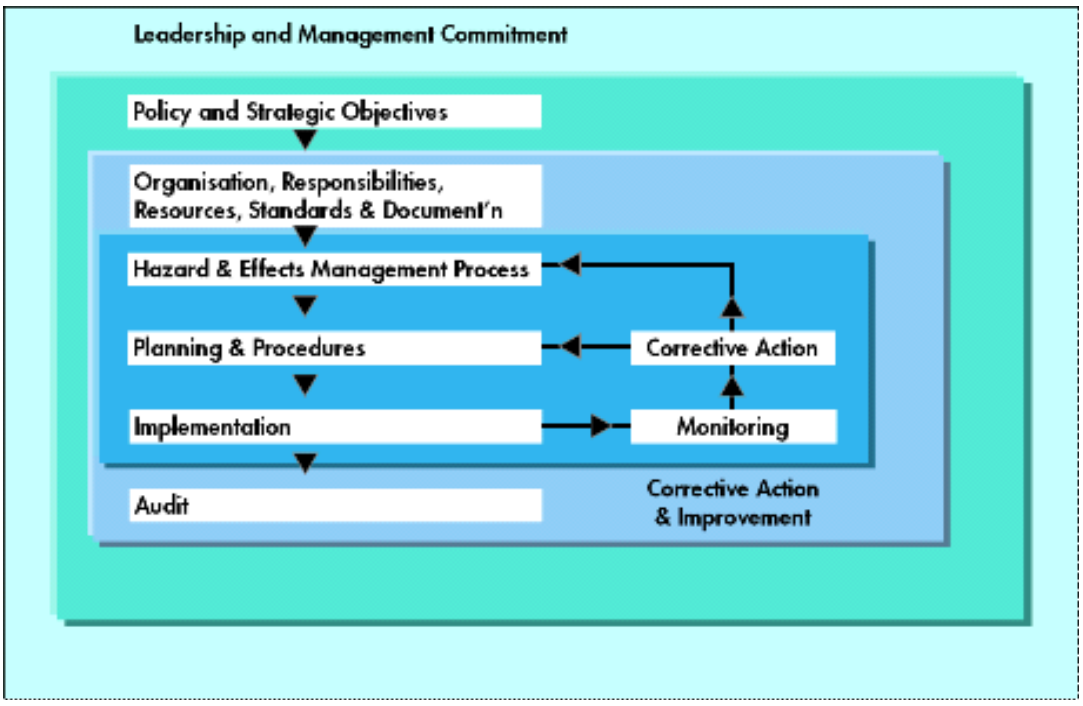
Shell has introduced life saving rules for personal safety showing commitment to people and where they focus their Safety Leadership attention. If a rule is broken, the result is immediate termination.

Strong leadership focus is needed in order to get to goal zero. This includes visible and heartfelt leadership, enhanced contractor engagement, improved HSE data analysis, and improved incident investigation.

Shell has verified their HSE Management System equals all the requirements of the U.S. Bureau of Safety and Environmental Enforcement SEMS program.



Shell's HSE MS – 8 Elements = SEMS – 13 Elements



Training

A good training program is essential to a strong Safety Culture.
Shell Robert & Kenia Training Centers

- HUET Training
- Super Safety, Life Saving Rules
- Fire Fighting, Crane Operations
- Defensive Driving
- Waste Management and Dept of Transportation Hazard Materials
- Open Water Rescue
- Major Emergency Management
- Behavioral Based Safety Management (BBSM)
- Cultural Awareness

In summary, what are attributes of a great Safety Culture

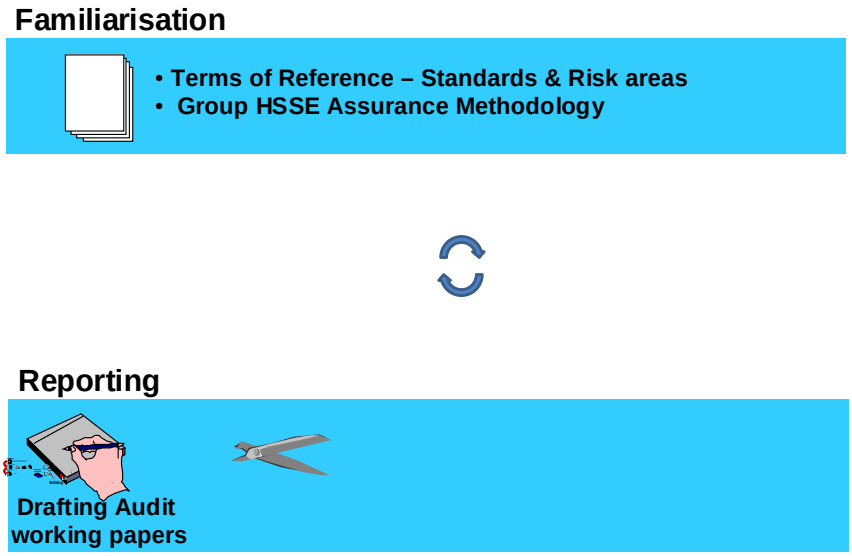
- Safety is part of everything Shell does
- Consistent leadership behaviours
- Great teams
- Open and honest communication
- Common goals
- People are professional and learning is valued
- Standardized practices
- Consistent rules which apply to all parties
- Standardized metrics
- Rigorous assurance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

Audits, Assessments and Metrics

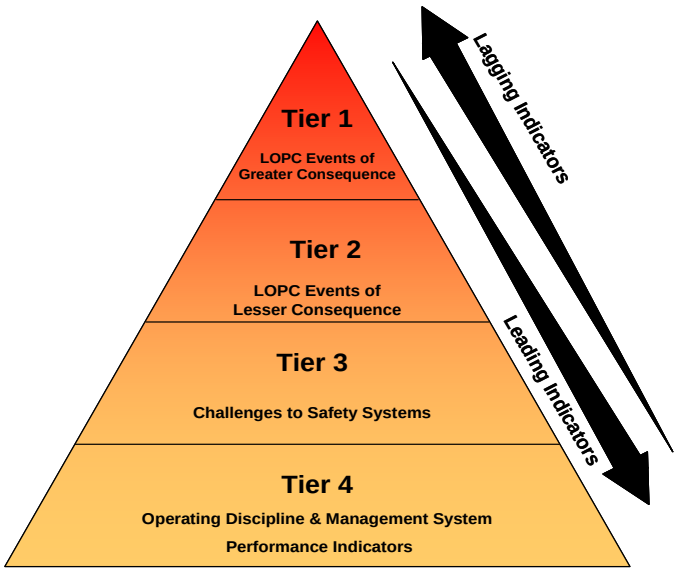
A key ingredient of Shells Safety Culture is a robust Assurance Process that has multiple levels of assurance;

- 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

Basic Reqts for all Audit Processes



Industry PS Performance Metrics - API RP 754 Four Tiers



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: HC spills, OSHA Recordables, fires

Concluding Remark

Results of anonymous surveys can provide indications of the companies Safety Culture. This is what Shell heard from some employees:

- "It is a pleasure to come to work and we are proud to work here."
- "It's a safe and secure workplace."
- "Our leadership *walk the talk!"*

There were other comments that were not so complimentary as well.

Discussion

Industry Corporate Culture

A participant noted that at the biennial meeting of the Society of Petroleum Engineers last week, Shells Lifesaving Rules were taken up by many participants indicating industry commitment to personal safety. In terms of near misses OGP has a database that tracks safety related incidents and OGP is working to compile well-control incident database and these are or will be on the OGP webpage. These are anonymous.

Capacity of Small Companies

A participant noted that Shell has spent a lot of time, effort and money to develop their management systems and safety culture, and asked if it is realistic to expect, at least in the U.S., a small company to do the same. It was noted in reply that this is a reason why there is not more uniformity in ensuring safety performance, because so many companies with different capacities are operating especially in the Gulf of Mexico. But industry does have institutions for guidance such as the Center for Offshore Safety, the Offshore Operators Coop, there is OGP and API. There is a hesitation in industry to share some data, but when it comes to safety, there is a strong willingness to share. The majors take a lot of this HSE development on their shoulders and then it is a matter of smaller companies to choose what fits their business.

Another commenter added that this sharing of safety information is one of the frontier areas for trade associations. A set of recommended best practices issued by OGP, for example, has little to offer a super major like Shell or Exxon, because most of the information comes from them and is repackaged. But it is valuable to smaller companies who can benefit from the work and experience of the larger companies. For personal safety, statistics show that small companies are starting to perform as well as large companies largely due to adoption and implementation of these recommendations and practices. This is not to say that a small company can operate as well as a large one in 3000 meters of water, and it is the responsibility regulator community to assess the company's capability.

Critical View

A participant noted that some of the majors have similar issues of implementation as small operators when looking at their global activity because their resources may not be distributed evenly. What is needed is a "Critical View." Both for regulators and from industry, and trade associations can help with implementation guidance—what "good" looks like. They suggested managing from the bottom up using global standards. For smaller companies that do not have the competence or financial resources to implement, they can do certain things first, and do them well, and then move to the next step. That is where industry can help with defining what the "Critical View" is, trade associations to confirm that, and the regulator to be willing to accept it. When standards are implemented across the globe, there is sometimes a little of everything in the mix and nobody is 100% sure of the exact details. The "Critical View" should be put in place 100% of the time for implementation. First the goal is established, then ways to implement them are laid out with a "Critical View."

HSE Elements

A participant noted that critical HSE elements were looked at in the last PAME workshop, the BSEE has identified 4 major elements common to all accidents on the US OCS, and NEB has also identified certain elements that were common to major industrial systems failure accidents in their Arctic Drilling Review. The HSE Management Systems project has also identified some HSE elements to look at in the Arctic Context.

U.S. SEMS program

A U.S. participant clarified that the SEMS program became mandatory after the DWH accident, but was not implemented because of it. SEMS was already being developed in a long process. And, it was around as a voluntary program for many years—but it was not mandatory because of the pushback from industry, especially smaller companies, who claimed it would burdensome.

Teaching and Communicating SEMS

Another commenter said that industry reluctance due to the burden of SEMS was a misperception, and that many smaller companies alre***a***dy address, in one way or another, all or some of the SEMS elements. Small companies cannot expect to have a system like Shell's or Exxon's. It will look different from operator to operator, location to location, and operation to operation. A self assessment of their systems will show where they have SEMS elements addressed and where they can improve. There is an education and communication aspect to dealing with small and mid-sized companies to help show them how some of their own elements fit within the expectations of SEMS. They may not have as an elaborate system as one employed by a major, but it will address the performance-based regulatory structure.

Contractors Safety Culture and HSE

A participant asked how Shell ensures there is an adequate safety culture all the way down through to the contractors and workers on the rig that is beyond just a paperwork exercise. They asked what is in Shells HSE Management Systems manual that can give the public confidence that measures are being taken by industry or the regulator that it is just more than words in the contract. Mr. Johnson replied that SEMS says that BSEE is not responsible for the contractors, it is the operator who is responsible. BSEE sets out the expectation that the operator is responsible for ensuring that all of the contractors meet the SEMS requirements. Shell has a group that does nothing but contractor safety, management and compliance. Shell only hires contractors that have those 8 HSE elements in their company and this is as important in their selection as lowest price. Shell audits the contractors to make sure they have these systems in place. The Industry does a pretty good job with the contractors, but this is not perfect, and the further it is away from the operator, down into the subcontractors and sub-subcontractors level, the harder it is. However, BSEE holds the operator accountable for all of them.

In response the a question if Shell has any recommendations how regulators can approach the issue of accountability as they move more into requiring safety culture, Mr. Johnson replied that in his opinion, the operator should be accountable, since they make the decisions. But in places like the Gulf of Mexico, it is a matter of capacity because there are so many contractors and subcontractors, it is a challenge to check them. Perhaps this could be done through random sampling.

A participant noted that the SEMS regulations are in the first round of a two-year period of evaluation. It is required in SEMS that a document (Bridging Agreement) that includes Safety Culture be signed between the operator and contractor (used to be a technical agreement on standard operating procedures). This is being evaluated to see if anything else needs to be done.

A participant commented that working as contractor in Norway, while working for various companies on the same platform, on several projects, that they all had different standards, i.e. management systems, work permits, etc., making it very inefficient and confusing and could contribute to failures. From an industry point of view, something that would drive the “critical view” to the lower levels, down the contractor/subcontractor chain, would be to develop clear, consistent procedures.

Common Standards

A participant from the Inuit Circumpolar Council wanted to know what is going on with respect to these issues in Russia. The Arctic is new frontier for oil and gas operations and is different than other parts of the world. Perhaps only big companies can work in the Arctic offshore. The idea of sharing practices between companies and countries and operating under international standards appeals to ICC.

Mr. Johnson believes that with a wide diversity of operators as in the Gulf of Mexico it is hard to standardize. However, if it is just the majors who will 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. Also there are only 5 possible Arctic nations with offshore oil and gas activities which also favors harmonization of standards or practices.

A comment was made that the 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. BSEE is interested in a bi-lateral discussion with Canada initially on common standards. The time may be right for a Arctic-wide discussion of this and could be a logical extension of the HSE project. The HSE element comparison table is a possible start to identifying where their might already be agreement to follow-up on.

It was additionally noted that the President's Commission also recommended that there be one set of standards and requirements in Arctic offshore operations, covering design, construction, transportation, installation, and removal of offshore structures. This approach could help the industry by simplifying and clarifying things.

Commissioner Ulmer summarized by noting that the Arctic is a small space, a new place, and there are few players. For establishing common standards: If not there, then where? If not now, then when? The AC and PAME are probably the situated to have meaningful discussions between regulators and with industry. There was a window created by the DWH for even considering something like common standards that has never been there before and may not last much longer.

Presentation: Mark Fleming

(St Mary's University, Halifax)

Safety Culture & Leadership Improvement--Modern day Alchemy

Professor Fleming talked about

- looking for balance in what we expect from culture,
- review for the International Regulators Forum on Safety Culture and Leadership
- a review of 17 major systems failure accidents and their cultural causes,
- Safety Culture improvement framework
- what has been learned.

Safety Culture seems now to be the ubiquitous cause of all accidents. Thirty to fifty years ago it would have been an Act of God and now it is an Act of Safety Culture. Some examples--"Coast Guard slams exploded Gulf rig's owner for poor safety culture;" "government panel blasts lack of safety culture in nuclear accident;" "hospital's poor safety culture blamed for death of stomach patients", etc. A lot of

disasters are simply blamed on lack of Safety Culture and many times does not add any extra value. It does not actually explain anything in terms of what happened or what can be done differently in the future.

This is a challenge. A lot of material is written and said about Safety Culture and it is all good, and nothing anyone would disagree with it, but helps absolutely nobody. There is however, some good guidance on how to approach safety culture and how it can be improved. This should be the focus, rather than repeating slogans and touting what is on paper. It is a lot more serious than that and there is a lot more effort involved. To use Shell's Lifesaving Rules as an example of a process that focuses on values, expectations, and what the consequences can be, but another company can use the leaflet and take the term "Lifesaving Rules," and they may look the same, but be implemented in a completely different way. That is a common problem, where a process is adopted but not implemented. Then when there is an event, the Lifesaving Rules are held up as poor practice when actually how it was implemented was wrong. There is a challenge in how things are adopted and spread across the industry—sometimes the spread is poor.

Safety Culture Definition

Other definitions of Safety Culture have been given at this workshop. This definition is from the Nuclear Advisory Committee on nuclear installations and is similar to the International Atomic Energy Administration definition. .

"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)

Culture determines *the extent to which you live your systems.* It is about the extent and the quality of things we do; not what we say we do. Are you living it? Is it real? Do you really do it? And, do you really mean it? A company can have all the paper systems in the world and all of the documents that look like Shell's good practice, but actually mean nothing in that other organization. Because fundamentally the culture determines how well you live those systems and that is what really matters.

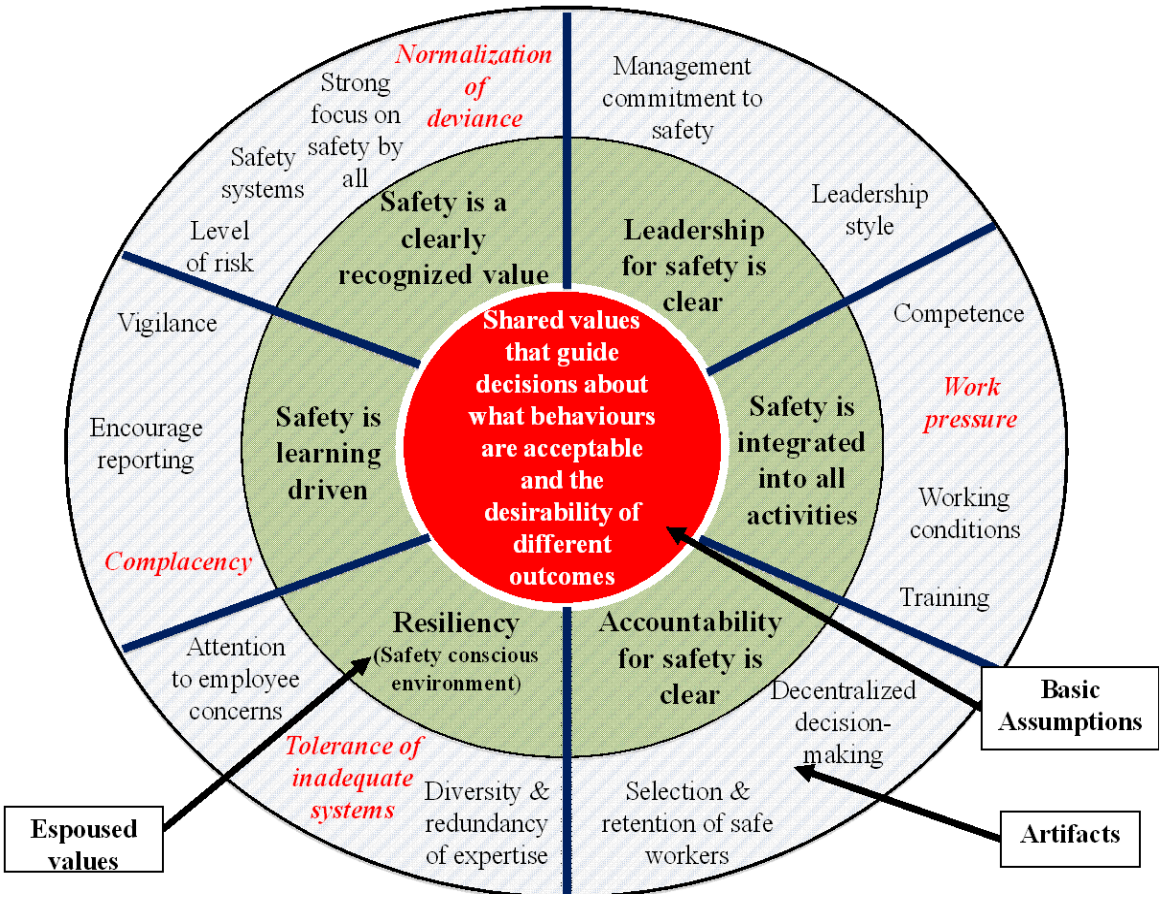
Safety culture review

Professor Fleming and his team did a Safety Culture and Leadership review for the International Regulators Forum (IRF).

- create a comprehensive framework
    - theory underpinning safety culture
    - main components of safety culture
    - attributes of a positive safety culture
- evidence of a relationship between safety culture and safety outcomes
- ways to assess or measure safety culture,
- improvement strategies

They were asked by the IRF to produce a comprehensive framework. To do this they reviewed large volumes of literature on Safety Culture and various models. They attempted to incorporate scientifically sound, identified, and repeated, main components and underpinning constructs of safety culture. In addition, they attempted to identify the attributes of a positive safety culture and what a positive safety culture would like.

The IRF also wanted them to look for evidence of a relationship between safety culture and safety outcomes, ways to assess or measure safety culture, and improvement strategies.



They set about creating this review and collating from a wide a group of sources as possible in comprehensive framework. In many ways, Safety Culture has been studied in domains—the offshore industry had studied it for a while, the nuclear industry studied it, health care has studied it. They attempted to pull across domains to get at the underlying construct.

They developed a model based on Shines Three-Layer Model of organizational culture. In the three different layers, there are basic assumptions at the core, which tend to be subconscious--we take them for granted and often find them hard to express; there's espoused values that tend to be clearer, and artifacts that are much

more observable and easier to see. They used this as the underpinning framework for their model.

In the center are basic assumptions defined as a "shared value system" that guide decisions about what behaviors are acceptable and desirability of different outcomes. The most desirable one is chosen from between different outcomes. For example, is it "getting into more trouble for missing the target" or is it "getting into more trouble for taking unnecessary risks?" This is a key aspect; a decision is made on the desirability of those two outcomes. Acceptable values in an organization are often reflected in acceptable behaviors. For example, racism is a value but people do not talk about the priority of racism—"being non-racist is my number one priority." Instead, values are talked about in terms of expectations of how one is going to behave. If one chooses to tell a racist joke, they would have to assume others would find it funny. They would have values, an expectation, of how their behavior will be encountered by others. In safety culture, a lot of what is seen will be reflected in people's behavior; what they do—and that is at the core of the model. The next layer is the "espoused values." These are what an organization say are important. And the outer layer contains artifacts.

They then looked at the dimensions of Safety Culture from a wide range of sources to see if there was a common framework that would make sense. After evaluating models from the nuclear, health care, and other high-reliability organizations, methods analysis in safety climate, and literature reviews, they developed a 6-dimension model that best summarized all of the models of Safety Culture.

Six Dimensions of Safety Culture

Leadership for safety is clear: Management and leadership staff are committed to safety. In any published psychological literature on Safety Climate or Safety Culture, Management's Commitment to Safety and even the style of leadership, will always come up as a clear dimension.

- 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 not a specific activity; it is how all activities are done. Therefore, it is integrated into all activities. This dimension comes from the IAEA and is about working conditions, competence, training, work pressure issues. A person needs to be competent in basic skills in order to be safe. Safety integration then is not just safety specific, but goes to the broader question of how an organization will be run.

- 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: It is important to have clear lines of accountability, including having people certify decisions by signing their names. But workers at the bottom must have the authority to make decisions and to stop work because safety concerns, without any negative consequences for that decision.

- 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: An organization should be built so that when something goes wrong it does not mean a bad event occurs. Mistakes should not lead to fatalities or major failure because there should be some resiliency in the system. Resiliency relates to diversity in thought processes, redundancy of expertise, attention to employee concerns, and tolerance of inadequate systems. The red "artifacts" in the model are negative indicators of a poor safety culture. 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: This means learning from previous events. A negative indicator in red in the model is "complacency." "It's never going to happen to us." Reporting and vigilance are encouraged. All of these issues come together in *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.
- Encouraging reporting all failures

Safety is a clearly recognised value: Levels of risk are established, and there is a strong focus on safety and safety systems. The negative indicator in the model is "normalization of deviance."

- It is clear to everyone that safety is the top priority.
- The importance of safety is demonstrated by

- the decisions managers make and
- how managers allocate resources.

All of the black attributes or "artifacts" on the outer ring of the diagram are positive indicators of a good safety culture. The four attributes in red are negative indicators and symptoms of poor safety culture. All four have been implicated in disasters.

Safety culture and disasters

Public reports in English of 17 offshore disasters were evaluated for cultural causes or factors. It was found that 14 of the 17 accidents had cultural causes. Of the three not having cultural causes, two were helicopter accidents with primarily technical reports and the third a thinly documented drilling accident. There were some incidents that were known to have reports but they were not procurable.

- Reviewed 17 offshore disasters to identify cultural causal factors
- 14 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)

Tolerance of inadequate systems: Of the 14 disasters, tolerance of inadequate systems and resources was identified 10 times as a factor in causes of offshore disasters. That means they knew that the system was inadequate or not functioning as intended, but continued operations anyway. They tolerated things that did not work and were willing to work-around, make-do, and mend, to get the job done because that was the environment they were in and something else was not considered an option. And these are not all small things. The industry has gotten good at replacing things that are cheap to replace, like redoing the stairs or fixing railings. But for something like replacing the control system for an offshore rig, that is a whole other scale of cost. Many offshore control rooms are badly designed or do not work as intended, so people learn to work around the issues. This is a challenge to the industry because the cost can be phenomenal to deal with these kinds of issues.

Some crew members had dubbed Macondo well "the well from hell."

- "this has been [a] nightmare well which has everyone all over the place"
- Wheeler (toolpusher) was "convinced that something wasn't right," . Wheeler couldn't believe the explanations he was hearing. But his shift was up.

Normalization of deviance: This is not a case of one person not following the rules. It is considered acceptable by all to break the rules, and rule-breaking is part of getting the job done. It becomes normal to not comply with the system as it was intended to operate.

- But, who cares, it's done, end of story, [we] will probably be fine and we'll get a good cement job. I would rather have to squeeze [remediate the cement job] than get stuck above the WH [wellhead]. So Guide is right on the risk/reward equation

Complacency: A belief that "we're great!." Complacency leads to a situation where there is evidence of warning signs but people do not take action on them. There is a tolerance of problems, problems building up, near incidents occurring, but no action being taken. It is interesting to note that the receipt of safety awards is a "predictor" of major safety incidents. Deepwater Horizon brought attention to that and Texas City, Commerce City refinery explosion, Shell Cormorant and Bravo, all had similar situations. Winning of safety awards should be the biggest warning sign to a company that complacency may be an issue. People start to believe that they don't have to follow the rules because they have 1000 days without a lost-time injury. It is a real challenge to fight complacency and try to get people to have "chronic unease."

- The Transocean managers discussed with their BP counterparts the backlog of rig maintenance. A September 2009 BP safety audit had produced a 30-page list of 390 items requiring 3,545 man-hours of work.

Work/cost pressure: Work Pressure and Cost was indicated only four times, which surprised the team because Professor Fleming thought the work pressure would be more important. It is possible it could be a "coding" issue, because his sense was that concerns about cost and schedule compromises safety, which seems obvious from many of the decisions made.

- BP's original designs had called for 16 or more centralizers to be placed along the long string. But on April 1, team member Brian Morel learned that BP's supplier (Weatherford) had in stock only six.
- Even after modeling raises concerns about increased risk by using only 6 and that in fact 21 were required. Only 6 were used.

Disaster prevention

Do not think of Safety Culture as an "Optional Extra"

Many companies see safety culture as something that is nice to have, or something they want to have confirmed or validated, rather than actually an active process that they need to work on day-to-day. A company may have a certified safety management system and so by definition must have a good safety culture, or not have had an injury for a long time and believe they have a positive safety culture. Rather than thinking comprehensively about what they are doing in an area and how good they are. Safety Culture is not an optional extra, when it is the core to how successful the rest of the system works.

Do not deceive yourself

Self-deceit is another big risk for companies. Many companies believe their own rhetoric—"drink the kool aide." They begin to believe their own PR. In doing a safety assessment for industrial clients Professor Fleming believes one of his major duties is to bluntly inform senior managers that they are completely wrong about where they think they are in their safety performance. It is also to scare them, because no matter how good they are, they are not good enough. There is a sense that companies want to be told they are doing a good job, but what they need to be told, even if they are doing a good job, is how to improve or get better.

Adopt a systematic approach

What the workshop should take away from this is to use a systematic approach to Safety Culture improvement. Take it away from vague and meaningless statements and into concrete and specific activities that companies are expected and required to do.

- Do not view safety culture as an optional extra
- Do not tolerate self deception
- Adopt a systematic approach to safety culture improvement

This may provide something meaningful and helpful.

Using the HSG 65 Safety and Management System model--Policy, Organizing, Planning and Implementation, Evaluation, Improvement and Audit Process[12], they developed a Safety Culture Improvement System..

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."

Safety Culture Vision: The company articulates policy on what they want in a culture and are clear in that vision. A one-page statement about their vision for safety culture can suffice.

- States the desire to continuously strive to improve the safety culture in pursuit of perfection

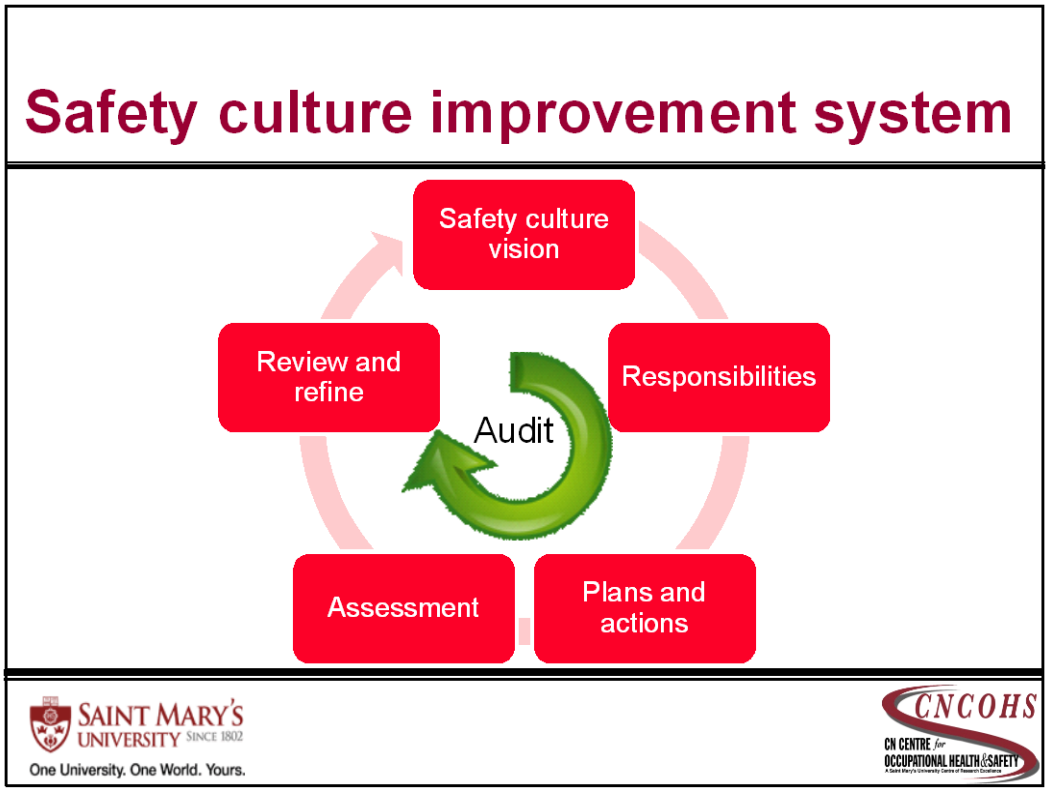
May include a definition of a positive (ideal) safety culture

Responsibilities and Accountability: It is fundamentally about defining the responsibility and accountability of key groups for creating and maintaining a positive safety culture. It defines the roles and actions of managers, supervisors, contractor managers, subcontractor managers, and non-managerial staff to promote a positive safety culture. A framework should be developed and an example was given earlier.

[12] http://www.hse.gov.uk/pubns/books/hsg65.htm

- 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: Plans and Actions are interventions or things we do to promote a positive safety culture. To start to improve safety culture we need a current review of practices. There are assessment tools to look at the processes associated with a positive safety culture and how to evaluate to improve. Long-term and short-term safety culture improvement objectives must be set and processes to promote a positive safety culture must be specified. All of this should link with the other aspects of the Safety Management System, such as training and incident reporting, and it becomes cleaar how culture is integrated into everything the company does. The company can say how the different parts of their Safety Management Systems are building a positive safety culture.
This table questionnaire is an example of the assessment process Professor Fleming and his team developed.

Many managers, who visit the rigs and interact with people and promote a positive safety culture, have no training on how to do it. Many managers may do more harm than good because they demonstrate a lack of commitment rather than actual commitment. Some majors have comprehensive systematic programs that train, track and evaluate managers on these visits. But few companies have a comprehensive program that includes all of the above, plus the quality of the managers visits as evaluated by the workers using anonymous feedback. There should be an upward appraisal feedback to management on how they are doing so they can improve their performance

- 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)

Sample: Commitment to safety

Managers Visiting the Worksite	Select level
Managers do not visit worksite to specifically discuss safety	0
Managers visit worksite regularly to discuss safety as specified by a formal policy/ program (e.g. STOP)	1
There is a formal manager worksite visit program that specifies the number of visits to be conducted by each manager and tracks completion.	2
There is a comprehensive program that specifies how to perform a worksite visit, trains managers how to conduct a visit, evaluates managers to ensure they are competent and tracks frequency of visits and close out of actions.	3
There is a comprehensive program described above plus the quality of the managers' visits is evaluated by workers and anonymous feedback is provided.	4

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Assessment: The Assessment element should be broken into two main categories. Episodic Assessment, which is a multi-method safety self-assessment process using questionnaires, interviews, and document reviews. Typically the oil industry has a pretty thin process for safety culture assessments. It is mainly a questionnaire-based assessment system that is done on an intermittent basis, with limited, closeout of any identified issues. The nuclear industry has a much more comprehensive approach to Safety Culture Assessments which define what the requirements are for the assessment. A questionnaire-based assessment for a nuclear installation would not be

credible or taken seriously. For a safety culture assessment, a multi-method approach must be used and questionnaires may be a part of that, but people must be talked to, documents must be reviewed, and other indicators must looked at. Although this is all useful information, it is episodic, it is done only every couple of years and it is quite a big undertaking.

Continuous Safety Culture Measures: Professor Fleming and his team have been trying to develop continuous safety culture measures a the Safety Culture Metrics Project with private funding. They are attempting to capture markers left by safety culture on daily operations and devise a continuous measure of safety culture on the basis of things people do on a daily. It is not easy, and they are not finished yet. But what they have concluded that it is about the *quality* of things and not the *number* of things. Industry may count the Stop Cards or Safe Observation Cards and that might tell management something. Professor Flemings team has been working on assessing the quality of the information submitted using numerical codes for classifying them on a five-point scale, 0-4. They have taken the framework shown earlier, and come up with a range of safety culture indicators and currently focusing on what information companies collect and how they can interpret it within a cultural frame.

- 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: The whole process is about improvement--review what is being done, refine it, and then audit against that. Check how well what is being done compares to all the different things the company says they are doing.

- 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)

This is the basic idea, on how to go about having a structured process for safety culture improvement.

Conclusions

- We need to be more critical about safety culture
- Regulators have an important role in promoting a positive safety culture
- Our understanding of safety culture is changing quickly
- The offshore industry can learn from other domains

Professor Fleming then talked about why he titled his presentation "Safety Culture—A Modern Day Alchemy?" He compared alchemists blind belief in their theories and the tendency to make the data fit their theories even when faced with disproof, to the immediate acceptance of Safety Culture as the cause of major systems failure accidents. And more importantly, the difficulty in disproving some of the alchemists theories is similar to theories of Safety Culture. Safety culture is accepted as truth without question, when often the evidence is pretty thin. Views of Safety Culture as the cure-all or cause-all of accidents should be critical and ask if it is it working, if it is it adding value. If it is not adding value, helping to improve, or does not make a difference, then it should be abandoned and a new way forward should be found.

Safety Culture is poorly defined. Professor Fleming recommended to the IRF to define it and be specific about it. How Safety Culture is used by various organizations is often an ephemeral unclear process. Therefore, it is difficult to determine cause and effect relationships, and it is applied instead of academic.

A difference between Safety Culture and Alchemy, is that much of the research is now more rigorous and is peer-reviewed and there is actual evidence to support some of the causal relationships. Some of the things actually do work in the way they should work, like leadership and safety outcomes. There is confidence that training managers to be more effective leaders, leads over time to improved safety outcomes. It has been clearly seen in occupational safety--when managers do the right thing from an occupational safety perspective, injury and fatality rates drop. There is some evidence then, that what was predicted actually works in practice.

Safety Culture is not the only approach. Research from different frameworks reach similar conclusions. High Reliability Organizations talk about the same thing as safety culture, but came at it from a different paradigm. It is a different framework. "Culture" was not popular in North America when the HROs were starting and they came up with the same thought and it was reinvented as Safety Culture.

What can we learn?

Do not accept the concept of Safety Culture as a given. It should be based on evidence. And if the evidence changes, people should be willing to change and to continue examining the causal relations. Even if the current theories on Safety

Culture are wrong, an important dimension of safety has been identified--how people feel and how they value safety. There is a lot of evidence to support that. What it is called is not as important as getting at peoples hearts and minds, which is crucial.

A parting thought--a quote from the captain of the titanic.

> *"When anyone asks me how I can best describe my experiences of nearly forty years at sea, I merely say uneventful. I have never been in an accident of any sort worth speaking about....I never saw a wreck and have never been wrecked, nor was I ever in any predicament that threatened to end in disaster of any sort."*

That is the problem with Low Probability Events. How many pilots flying around today have ever been in a major event? Very few--they either died or they are retired. There is a sense that 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.

Discussion

Six Dimensions of Safety Culture

A participant asked where the economic and legal drivers fit into the dimensions of Safety Culture. In reply Professor Fleming pointed out that what he described in the model are the dimensions of an organizations structure. These are the facets that are relevant in different contexts. The model describes all of the things that should be considered when trying to understand the organizations culture in a comprehensive way. The "why" of being safe or less safe may be driven from economic or legal factors, but this model describes the culture, not the motivators of the culture. It is used to help understand the range of things an organization should consider. For example, Safety Culture questionnaires often concentrate on issues like "Is my manager committed," but are not asking about things like "the extent of built-in redundancy in our system." And that is important to being successful. If there is no resiliency in the system, then there is little likelihood of being successful.

Safety Culture Continuous Improvement Project

In response to a question on the project on continuous assessment Professor Fleming explained they are about one-year into a three year project. They have established a Steering Group to evaluate the metrics they have produced. Regulators are not members of the steering group, but regulators are and can be part of the "Advisory Network." They based their Safety Culture improvement project on the IAEA model because it has 137 attributes of a positive safety culture to work with. Work for this academic term is to evaluate these attributes for application to continuous improvement of safety culture because many of these attributes did not operate on a timeframe that facilitates continuous improvement. Those that could be tracked on a regular basis, are being turned into indicators. Next steps are to start trying the model and release it for comment. They are not going to wait until the end of the project to release results. They have established the International Safety Improvement Network

and a web site is under construction to share information. They want critical feedback as to whether it makes sense and get input into the process from as many likeminded people as possible.

International Safety Culture Improvement Network

- Cross-industry collaborative (offshore, nuclear, construction and healthcare)
  - Create a repository of safety culture documents
  - Capture best practice
  - Develop safety culture metrics
- If interested in joining then send Mark Fleming an email mark.fleming@smu.ca

Definition of Safety Culture

It was noted by a participant that a question about the sources of four major companies HSE management systems received four different answers in the DnV Report for the RP3 project in the EPPR working group. This implies there are no common or similar sources for Safety and Environment Management Systems and identifying these sources might be something to think about. In response, Professor Fleming noted that for Safety Culture, it is defined. There are number of roughly similar definitions. He advised that 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 actually do something about safety culture, an organization has to define it as what they mean by safety culture. Other things can be done, but if it does not fall into the definition, then it is not safety culture.

Professor Fleming used the example of a LOSA (Line Operation Safety Audit) for airlines in the United States, where independent auditors observe behavior in the cockpit and record key information that is fed back to the airline. This provides a sense of what the behavioral compliance is with the rules and procedures in a real-time meaningful way. Although LOSA is not mandatory, it is strongly recommended. If it is implemented, it must have ten particular defined LOSA elements and if it does not, it cannot be called a LOSA. Something similar would be really helpful from a safety culture perspective. For example, a company may say they are doing a safety perception survey, but it is not a safety culture self-assessment unless it meets the requirements that are defined. This should not stop an organization from doing other things, it just precludes them from saying something else. It is important to be clear in what is meant by taking certain actions to avoid some self-deception.

A participant asked what the key is to defining safety culture in order to render it susceptible to regulation. Professor Fleming replied that Safety Culture is susceptible to regulation. It is not difficult to regulate and is done in Norway. To regulate anything though, it has to be clear what is meant and what the expectations are surrounding what is done. That is where the challenge arises. And, rather than defining it as an outcome, what is really needed is to find a process by which an

organization will put in place a consistent policy for safety culture that 1) says the organization has a safety culture and defines it, 2) has a process to support and improve Safety Culture, and 3) a solid methodology to actually assess the extent that they are really doing what they say they are doing. As with management systems, safety culture is abstract constructs. It is only a problem when people believe that safety culture equals safety attitude, which it does not. Employees may be asked for their perception of management commitment to safety, but that is not their attitude toward safety. Regulating safety culture is doable.

Open Discussion Wrap-Up

Dennis Thurston restated the three questions that were included in the background material for the workshop.

- ***What can we learn about safety culture in the Arctic from the Deepwater Horizon and other offshore drilling accidents?***
- ***What can we learn about safety culture in the Arctic oil and gas industry and regulatory community from other industries and activities such as Naval, Aviation and Nuclear?***

And perhaps the most important to the HSE Management Systems project in PAME:

- ***What is the advice regarding Arctic offshore operations that can be given to regulators and policy makers about safety culture and offshore operations?***

The floor was opened for discussion.

The PAME HSE Project

In response to a question on how the findings and recommendations of this project align with the SAO and Ministerial meeting, it was pointed out that is on the agenda for discussion at the PAME meeting after the workshop. Originally the completion of the HSE Management Systems project was not tied to the Ministerial meeting in May 2013. The project was to take as much time as needed. But after involvement and coordination with the RP3 project in EPPR, the HSE project changed their timeline. The plan currently is to have the Report and Recommendations, small and fairly succinct, completed by the Ministerial. This will be discussed in the PAME meeting[13].

The plan at this point is to have some recommendations on Safety Culture taking into account what we have heard today, and tie that in with some of the HSE elements—all within an Arctic context, or Delta Arctic as RP3 has described it. The focus will be

[13] . It was decided in the PAME meeting to deliver Workshop Reports and Report appendices by the Ministerial as part of the MRE WIR, with full report delivered by Fall 2013 or Spring of 2014

on what is different in the Arctic than in other places, what is unique or exasperated by the Arctic; cold, darkness, remoteness etc, and how do they relate to specific HSE elements. There will be a few new recommendations and the restated negotiated recommendations on HSE Management Systems from the 2009 Arctic Offshore Oil and Gas Guidelines. There will also be appendices, which include the comparison tables for the different HSE Management Systems that are employed now in the Arctic for several countries, a table of a few of the elements that have been found to be central or contributing causes to accidents with consideration of their implications for the Arctic, a list of investigations into the Deepwater Horizon accident, and a list of HSE Management Systems Guidance documents.

The draft will be circulated and the two workshop participants will involved in the process to assure that their information was captured and utilized it in a logical and correct way. The workshops are important for informing the HSE project work. It is a little too soon to make final determinations until the results of the workshops are digested and discussed among the Oil and Gas Contact Group and in the PAME meetings. There is plenty to work with, and the workshops have been very helpful and informative. It is hoped that the workshops have been useful to the participants in learning more about the systems used in various countries, jurisdictions, and industries and in bringing people together to discuss these issues. If anyone has any reflections or thoughts they are invited to submit them to PAME.

Arctic Nations Roles in Influencing Safety Culture

Commissioner Ulmer summarized thoughts on the workshop by first sharing a simple definition of safety culture--*"the shared values, norms and activities used by an organization to manage risk."* Some of things that influence how an organization manages risk, such as how much investment they make, are completely out of government's control. But others are actually within government's control. Therefore, from the perspective of the Arctic Council and PAME, the focus of the recommendations should be on things that are *"influencive."* Focus on what governments, existing organizations like the IRF, or some new organization, can do to improve safety and the environment. A possible product of this project could be a set of recommendations that governments could at least agree on trying, to create incentives for safety culture improvements. This could "move the ball closer to the goal post."

A participant asked what actions might be taken in order to foment and actually regulate safety culture. To write guidelines for governments, there has to be a definition of what exactly is a satisfactory safety culture or satisfactory management system. They suggested that the appropriate way forward seems to be to figure out what Arctic Council States can contemplate doing that would allow the states and other relevant actors to best promote effective management systems and better safety culture.

It was pointed out that PAME is not making recommendations to the corporations anyway, they will target the regulators and policy makers but it will emphasized that HSE Management Systems and Safety Culture are a partnership between industry and regulators and labor. This point was made clearly in several presentations at the workshop. The regulator influences industry's culture; they are tied together. In a prescriptive regime, it is hard for a company to improve and maintain positive safety culture when they have a compliance mentality. These are often mutually exclusive. In the final report, the language will be negotiated, but it will be recommendations to the Arctic States Ministers, for consideration by the Arctic States much along the lines of the Offshore Oil and Gas Guidelines.

Safety Culture concerns Industry

A participant felt that the focus of safety culture should not just be on the corporations and their activities—there are multiple actors--industry, governments and investors. Culture is impacted by multiple actors, states and operators. They did not think it was appropriate and perhaps dangerous to think of safety culture in the offshore, broadly writ, as housed within the operators. They saw it as a set of norms, indicators and activities that are part and partial of a liability regime, expectations of the public, and social license to operate. All of which has to come together.

Another participant disagreed that it is bigger than the corporation. Safety and influencing safety are bigger than the industry, but safety culture is not. It is how organizations live ***their*** safety management systems. They warned it would be a mistake to invent something new by broadening its scope or redefining it, and calling it safety culture. There are many factors for performance of an organization in hazardous environments, such as legislation, business environment, and tolerance of risk. And there are processes that use safety outcomes for an organization or industry. But if this is about safety culture, then it should stay within the broad and current understanding, as being the shared values that exist within a particular organization. The regulator influences it by the norms and guidance, and national culture will influence it to a certain extent. But fundamentally, what is understood to be Safety Culture from the way it has been studied for a long time is that it ***is within*** the corporation. That is the frame they use and strongly recommend to this group to continue to use, rather than deciding to go to something new.

A participant suggested 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. This has the advantage of allowing new and different ways to implement and improve the system and process, as opposed to the rigidness of a prescriptive regime. They suggested that a definition of safety culture is something the project should consider to help the regulators understand what they need to require.

Safety Culture Expectations

A participant said they would like a way to capture some of these qualitative definitions or expectations of what safety culture looks like and get them into a useful regulatory format. A lot of nebulous things must now be defined by the regulator, but going back to a checklist is not a good option. They suggested making sure that this project does not come up with a whole new set of indicators that might already have equivalent systems. The goal of positive safety culture is important, and there should be tolerance of diversity in how it is approached. They do not have to look alike between operators, except for a core of expectations that must be met. In order for a corporation to implement their HSE or Safety Culture expectations in different countries, they will look very different. The safety culture expectations need to be a little more common, but not exactly the same.

The HSE Project and PAME

A participant suggested the PAME HSE project may be able to help address defining safety culture. Another participant countered that PAME as a policy oriented group does not generally get into technical detail in their guidance or recommendations, but rather give the Arctic nations a fairly high-level understanding. They believed that the HSE Project should focus more on a clear vision of what the project will achieve and what it is *not* going to deal with. They wondered if the project will be able to come up with a set of recommendations that takes into account the very different systems and the disparity in what is in place, or not, in different countries. It was noted that Norway is a leader in Safety Culture and in application of HSE Management Systems and perhaps PSA and Klif will be able to contribute more substantially in these discussions.

There was a discussion about the link between safety culture and PAMEs mandate of protection of the marine environment. It was pointed out that major accidents almost always do something devastating to the environment—this is especially true in the Arctic marine environment and that is one tie-in with PAME. This was covered in the background papers for this workshop. The other possible link to PAME is that their mandate also includes policy recommendations for protecting the marine environment.

NEB Safety Forum

A participant from the National Energy Board of Canada extended an invitation to attend the ***Safety Forum June 5-6, 2013***[14] in Calgary. It will focus both on the onshore and the offshore. Copies of the Special Paper NEB just released on their website were made available. This paper identifies what NEB thinks are the emerging issues that came out of the Macondo well blowout investigations and other major

[14] http://www.neb-one.gc.ca/clf-nsi/rsftyndthnvrnmnt/sfty/nbsftyfrm2013/nbsftyfrm2013-eng.html

events. NEB wants to look three issues in the Safety Forum: 1) *performance safety metrics* that influence hazards identification and risk management; 2) *senior leadership and its role in safety culture*; and 3) *management systems effectiveness and implementation*. NEB has asked a number of questions of senior leadership so that they can start digesting and thinking about the issues. NEB would like to see as many jurisdictions at the Forum as possible for comparisons.

About the Speakers

Hon. Fran Ulmer
U.S. Arctic Research Commission

Fran Ulmer is chair of the U.S. Arctic Research Commission, where she has served since being appointed by President Obama in March 2011. In June 2010, President Obama appointed her to the National Commission on the BP Deepwater Horizon Oil Spill and Offshore Drilling. From 2007 to 2011, Ms. Ulmer was chancellor of Alaska's largest public university, the University of Alaska Anchorage (UAA). Before that, she was a Distinguished Visiting Professor of Public Policy and Director of the Institute of Social and Economic Research at UAA. She is a member of the Global Board of the Nature Conservancy and on the Board of the National Parks Conservation Association.

Ms. Ulmer served as an elected official for 18 years as the mayor of Juneau, a state representative, and as Lieutenant Governor of Alaska. She previously worked as legal counsel to the Alaska Legislature, legislative assistant to Governor Jay Hammond, and Director of Policy Development for the state. In addition, she was the first Chair of the Alaska Coastal Policy Council and served for more than 10 years on the North Pacific Anadromous Fish Commission. She has served on numerous local, state, and federal advisory committees and boards. Ulmer earned a J.D. cum laude from the University of Wisconsin Law School, and has been a Fellow at the Institute of Politics at the Kennedy School of Government.

Hon. Donald C. Winter
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.

Rear Admiral David M Duryea
Deputy Commander for Undersea Warfare (SEA 07)

Rear Adm Duryea is a native of Orchard Park, New York. He graduated from the University of Rochester in May 1983, earning a Bachelor of Science degree in Geomechanics. He has a Masters Degree from George Washington University.

Rear Adm Duryea's operational assignments include Division Officer, USS Lapon (SSN-661), Combat Systems Officer, USS Puffer (SSN-652), Anti-Submarine Warfare Officer, Carrier Group 7, Executive Officer, USS Honolulu (SSN-718), Deputy Commander for Operations, Submarine Squadron One, and Commanding Officer USS Florida Gold (SSBN 728G).

Shore Duty assignments include Staff Action Officer for Tactical Warning and Attack Assessment Systems at United States Strategic Command J6, and Force Engineer, Commander, Submarine Force, US Pacific Fleet.

Following Command he was assigned as the Program Manager, Advanced Submarine Systems Development Office /Deputy Director of Undersea Technology, Naval Sea Systems Command, Major Program Manager, Submarine Imaging and Electronic Warfare Systems and Major Program Manager, Special Operations Forces Undersea Mobility Program Office. He is currently serving as the Naval Sea Systems Command, Deputy Commander for Undersea Warfare where he oversees the US Navy's Subsafe Program.

Dwight Johnston
Dwight graduated from Texas A&M University in 1977 with a BS in Civil Engineering. He started with Shell in Houston, working his first few years in a variety of Facilities and Project Engineering positions. Dwight and his family moved to Bakersfield, California in 1983, where he served in his first supervisory position. While in California, he held positions as a Field Operations Foreman and as a Facilities Engineering Supervisor. He then spent one year, back in Houston, in a corporate planning position before he transferred to New Orleans in 1988. In New Orleans, Dwight held a variety of positions, including Asset Manager, Project Manager, HSE Manager, Operational Excellence Manager and Operations Services Manager for Shell's GoM operations. In August, 2009 he moved to The Hague, Netherlands to serve as the Global Process Safety Manager in Shell. He moved back to New Orleans in April, 2012 and currently serves as the VP HSE in Shell's Deepwater Business Unit. Dwight has a wife and 3 children and goes fishing whenever he gets a chance.

Mark Fleming MA, MSc, PhD
St. Mary's University, Halifax

Mark arrived in Canada in the summer of 2001 to take up a position in the department of psychology at Saint Mary's University in Halifax. He was one of the founding members of the CN Centre for Occupational Health and Safety Centre and is on the Board of Directors of the Centre. Before coming to Canada he worked as a consultant

in Scotland. He has over nine years experience working with the Offshore Oil and Gas industry in North Sea. He has authored numerous reports for the UK Health and Safety Executive. He has particular knowledge of safety culture, behaviour modification and the key role played by the first-line supervisor in managing safety effectively

Current areas of interest

- Developing practical tools to measure and improve safety culture
- Improving the effectiveness of behaviour modification programmes
- Investigating the human factors causes of error
- Applying a risk assessment model to management and reduction of work-related stress
- Exploring ways to improve communication between shiftworkers.

List of Attendees

Anatoliy Mikailov	Russia	RAIPON
Anja Elisenberg	Norway	Ministry of Environment
Barbro Thomsen	Norway	Climate and Pollution Agency
Betsy Baker	USA	Vermont Law School
Elizabeth McLanahan	USA	National Oceanic and Atmospheric Administration
Fran Ulmer	USA	Arctic Research Commission
Celine Sirois	Canada	National Energy Board
Claudine Bradley	Canada	National Energy Board
Dag Oluf Nessa	Greenland	Bureau of Minerals and Petroleum
David VanderZwaag	Canada	Dalhousie University
Dennis Thurston	USA	Bureau of Ocean Energy Management
Donald C Winter	USA	University of Michigan
Duane Smith	Canada	Inuit Circumpolar Council
Dwight Johnston	USA	Shell
Peter Oppenheimer	USA	NOAA
Phil Mundy	USA	NOAA
James Stotts	USA	Inuit Circumpolar Council
John Campbell	UK	Oil and Gas Producers International
Julia Swindle	USA	International Association of Drilling Contractors
Marc Montemerlo	USA	U.S. Coast Guard
Mark Fleming	Canada	St. Mary's University
Maureen Copley	Canada	Aboriginal Affairs and Northern Development
Susan Dwarnick	USA	Bureau of Safety and Environmental Enforcement
Jette Vester	Greenland	Bureau of Minerals and Petroleum
William Amos	Canada	Ecojustice

PAME

Protection of the Arctic Marine Environment

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