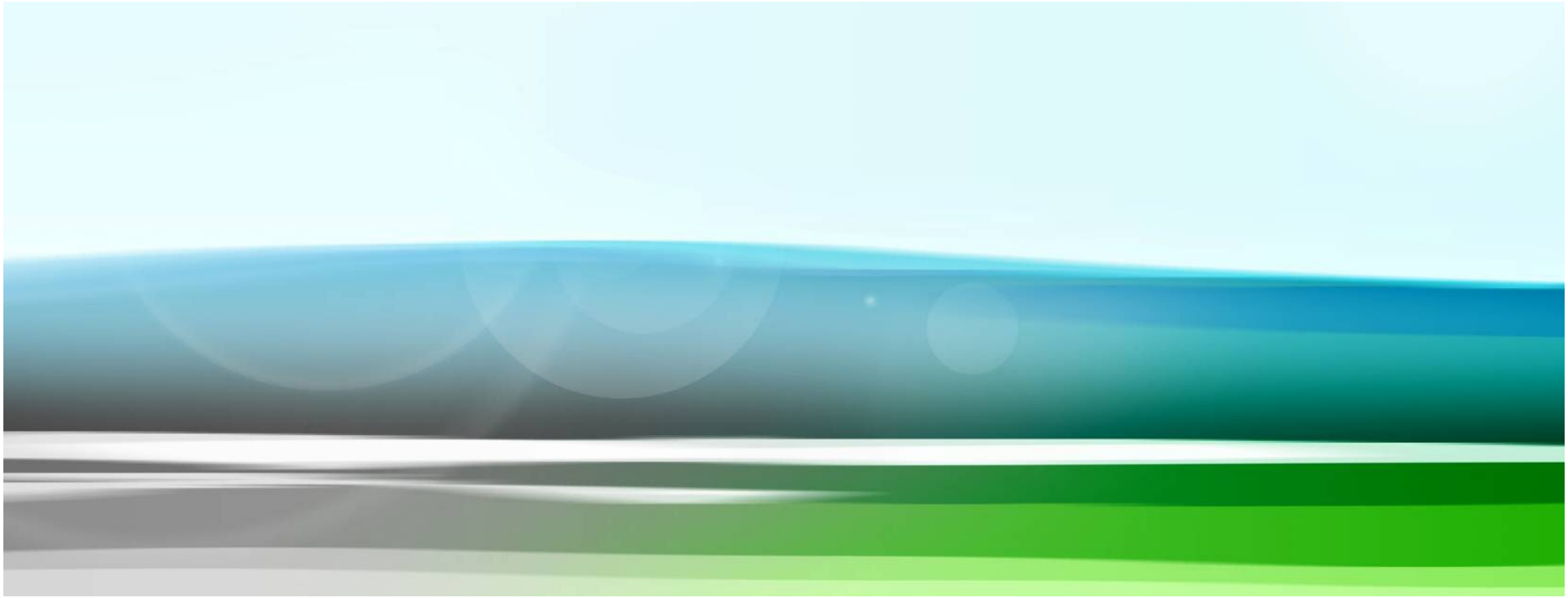


Macondoutblåsningen i et Regelverksperspektiv

ESRA Norge - 7. april i Stavanger: Brønnintegritet og utblåsningsrisiko

Lars Tore Haug
2011-04-01

MANAGING RISK

Content

- Consequences of major accidents – regulatory response
- Deepwater Horizon – a new game changer?
- Vision – Step Change Improvement for Major Accidents
- Some ongoing changes in the regulations

Recap – Why Are We Here?

- April 20, 2010 About 21:45 local time, gas under high pressure flows uncontrolled up from the Macondo well onto the rig Deepwater Horizon. The gas ignited, resulting in fires and explosions. The rig is a total loss.
- 11 fatalities and 17 injured
- Oil leakage:
  - From April 20 – July 15 (well capped)
  - US experts suggest initial rate was 63,000 b/d declining to 53,000 b/d (4.9m bbls in total)
- Static and final bottom kill successful
- Largest oil spill event in US history
- Many countries, NGO's and stakeholders call for more regulation of the industry.

Consequences of major accidents – regulatory response

NEW REGULATORY REQUIREMENTS

- Alexander Kielland – Structural redundancy
- Exxon Valdez – Double hulls

RISK METHODOLOGY

- Bhopal & Seveso - Seveso directive
- Piper Alpha – “Safety Case”
- Texas City – increased safety for process industry

CORPORATE MANSLAUGHTER

- Herald of Free Enterprise
- Scandinavian Star

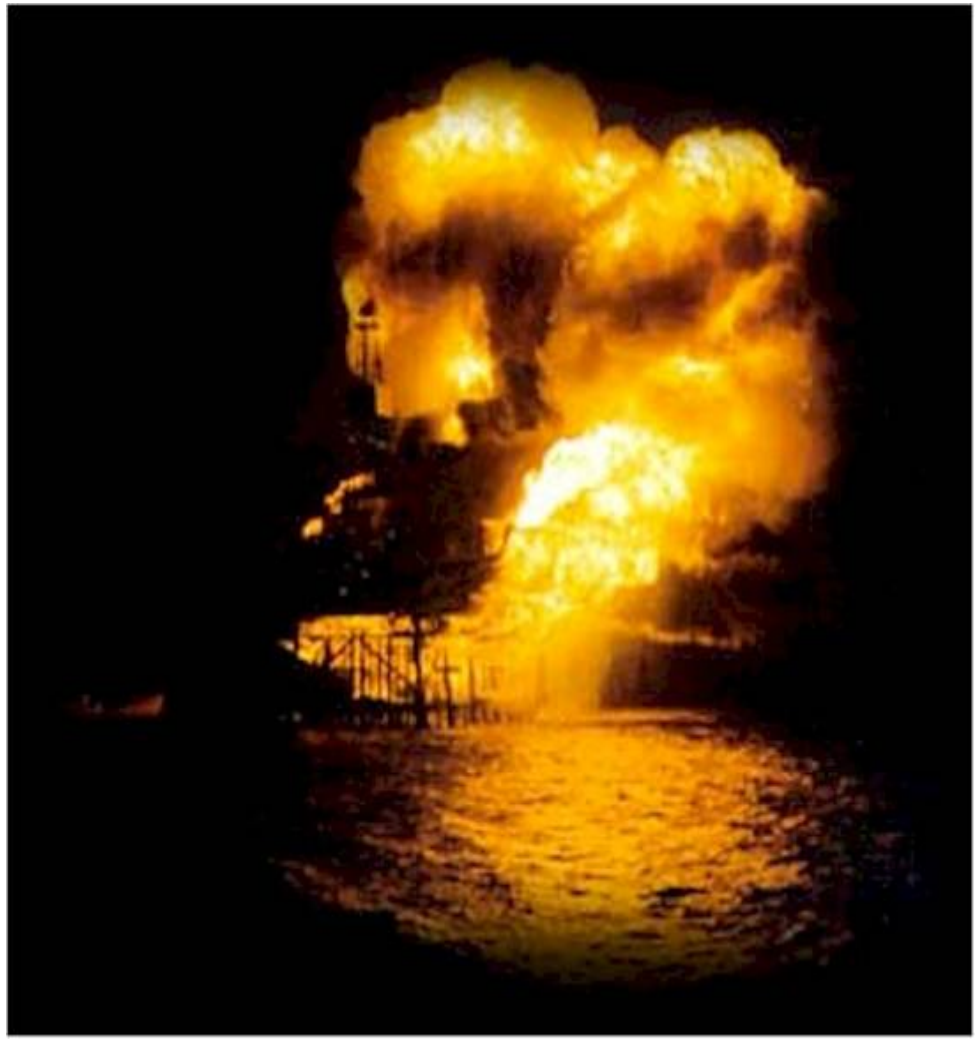
NEW REGULATORY BODIES

- Flixborough – HSC in UK, HSWA
- Piper Alpha – UK HSE now extended to offshore

FINANCE

- Enron – Sarbanes-Oxley

MACONDO and MONTARA BLOWOUT ?????



Deepwater Horizon – a new game changer?

- **Yes –** we are facing a loss of confidence in the industry, with significant impact.
- Several severe incidents the last 2 years contribute
  - Montara blow-out in Australia
  - Aban Pearl semi lost offshore Venezuela
  - Gullfaks C loss of barriers
- Why is this one significant?
  - **Scale** – largest oil spill ever x 2
  - **Location** – USA + elections + mass media
  - In the new social media age, there is nowhere to hide
  - **Company involved (**BP, a major 'foreign' IOC to the Americans, with a poor track record in the USA)

All contribute to make Deepwater Horizon a **game changer!**

Vision – Step Change Improvement for Major Accidents

DNV believes major accidents can also be reduced 10x – via an integrated approach

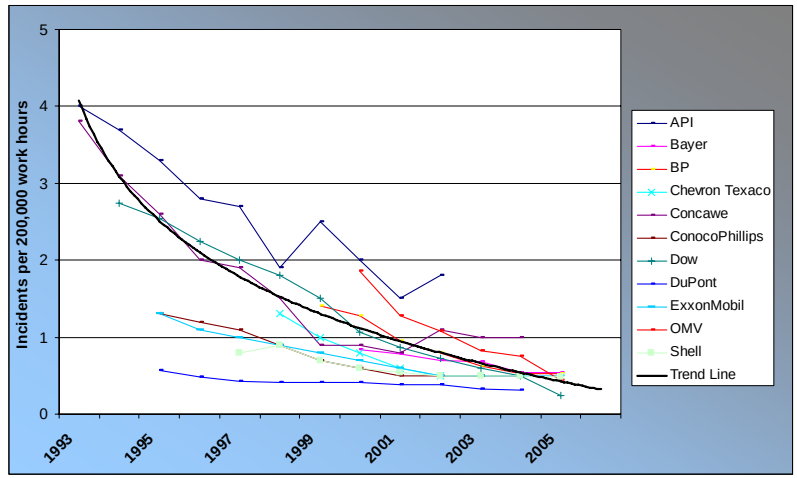
1. Revised regulatory regime: Blend of Prescriptive and Performance-based regulations
2. Address technical, human and organizational factors: Key lessons from past accidents, think about barriers
3. Enhanced and enforced risk management approach: Addressing Risks, Controls and Condition through the lifecycle
4. Clear roles and responsibilities: Clear to all, and reinforced through an effective culture
5. Shared performance monitoring: All information is readily available when and where needed, and recognised for its significance

DNV believes:

- This is practically and economically feasible
- Methods described are in use – but not fully integrated
- Skills and experience available in the regulator, industry, contractors, and 3rd parties

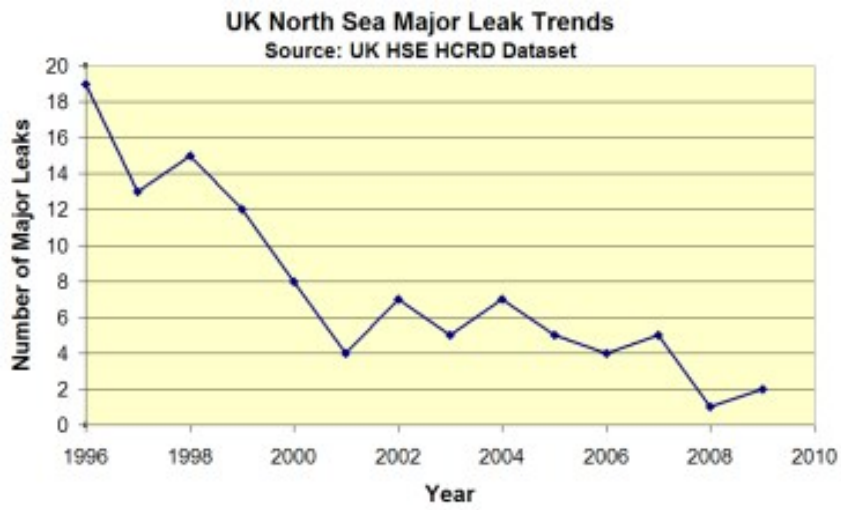
What the Oil & Gas Industry has and has not achieved

- Over the last 20 years the industry has attained a **step change** (factor of ten) improvement in occupational safety
  - Graph shows factor of 3 in last 10 years



- USA and EU Process Industry
  - Neither EU nor USA has demonstrated significant improvements for onshore major accidents (OSHA PSM, EU Seveso Directive)
  - Chemical Safety Board and Baker Panel highlighted after Texas City that Process Safety (major accidents) and Occupational Safety (personal accidents) are NOT the same

- North Sea major accident safety has improved
  - No major disaster since introduction of Safety Case / risk based legislation in UK / Norway (leaks have occurred, but none escalated)
  - Reducing trend in major hydrocarbon leaks
    - Factor of 10 in last 13 years – UK HSE Database
    - “What doesn’t leak can’t explode…”



How do we improve regulations?

1) By having a “instant” reaction and issuing regulations specifically targeted at the event that has happened?
2) By setting prescriptive regulations directed at the last incident?
3) By more effective implementation of what we already have?
4) By understanding the root causes of an incident, and engaging the industry in identifying ways to avoid accidents which present risks to Safety, Environment and Profitability
5) By requiring operators to demonstrate to stakeholders (not just regulators) how they will design, operate and decommission their facilities in a safe and environmentally responsible manner
6) By setting improvement goals for the industry, and verifying how they are achieving those goals.

Reaction and Reflection

Key regulatory regime differences (USA and EU)

- The EU regulations are mainly **performance-based**
- The U.S. regulations are primarily **prescriptive**

- The intention with a performance-based regime is to make the **operator regulate its own activities** when it comes to safety, health and environment (SHE)
- The intention with prescriptive regulations is to prevent accidents by identifying specific technical requirements that the **operator must comply** with. The Authorities control the operator's activity through approvals and inspections.
- DNV's experience is that performance based (goal setting) regimes backed by independent verification of key barriers are the most effective.

Step Change – How can this be achieved?

Prevention:

1. Understand all failure modes, their risks, and needed controls for “Step-Change”
   - More sensitivity studies and “what if” analyses. Don’t assume in risk assessment that barriers are infallible
   - Demonstrate how improvement is achievable through design and operational controls
   - Remember the human element when identifying failure potential (including in decision making)
2. Identify and monitor the status of all barriers throughout life
   - Better barrier models with continuous status updating and effective communications
   - Degraded barriers must be addressed, and fed back into risk assessments
   - Improved knowledge of equipment failure frequencies – share more data in the industry
3. Fully comply with Regulatory and Company requirements
   - Exemplary Conduct of Operations and Operational Discipline
   - Oilfield Teamwork (offshore + shore-based staff) solving problems and monitoring actions

Mitigation:

4. Demonstrate effective mitigation strategies to deal with major or catastrophic oil spill events
5. Demonstrate effective response strategies to contain, capture and dispose of oil safely

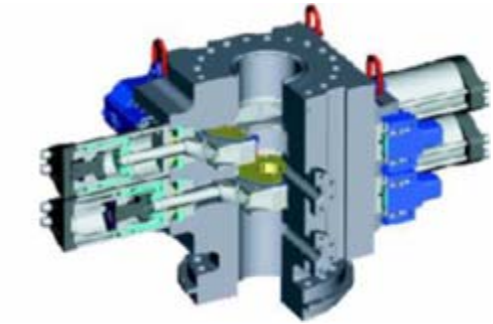
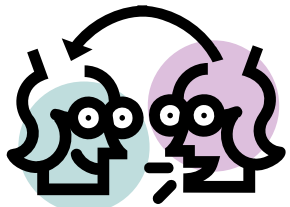
1. Revised Regulatory Regime

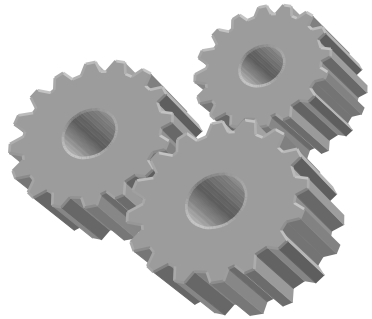
Blend of Prescriptive and Performance-based regulations

- The industry has deep knowledge of hazards and risk management
  - New processes or new development approaches can however introduce novel hazards
  - Industry can carry out risk assessments, define necessary controls and monitor conditions
  - The Operator must carry the responsibility for proper Safety and Environmental protection
- Authorities / government agencies have specialist manpower – but limited in number
  - Regulators and regulations should focus on the most important issues
  - Blend updated Prescription based standards with Performance style regulation
  - Clearly define needed safety barriers and assign required performance and ownership
  - Regulator should ensure the competence of those doing inspections – not attempt all itself
  - Combine safety & environmental regulation
- Capture this in a **Safety Case**-style Regulatory Regime
  - Operator **demonstrates** the high level of safety that will be achieved and maintained and that all key barriers are functioning at their required performance level
  - Independent verification of people, process and plant barriers
  - Cover both safety AND environment

2. Address Technical, Human and Organizational Factors

- This lesson has been clearly learned from many past disasters
  - Esso Longford Fire / Texas City Explosion / Three Mile Island / NASA Challenger
- Purely technical solutions do not address all important failure modes particularly in people & business process areas
- A step change will require all three aspects:
  Technical, Human and Organizational



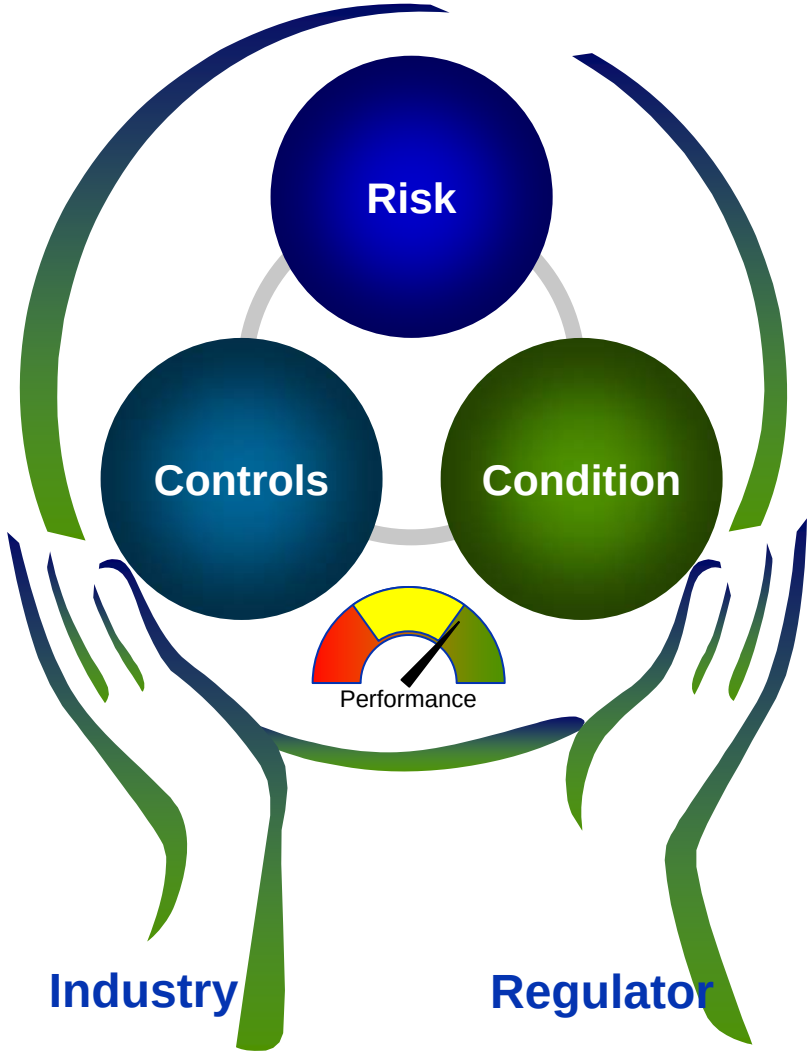
Improve technology qualification and interface handling

- New technology need to be **systematically qualified** the specific environment and operational scenarios where it will be applied.
- **Interfaces** between systems and operations need to handled in a systematic manner and be part of the qualification process.
- Ensure that existing known technology applied outside present area of experience is qualified for the new application areas.

BOP, Deep Wather Horizon (US. Coast Guard)

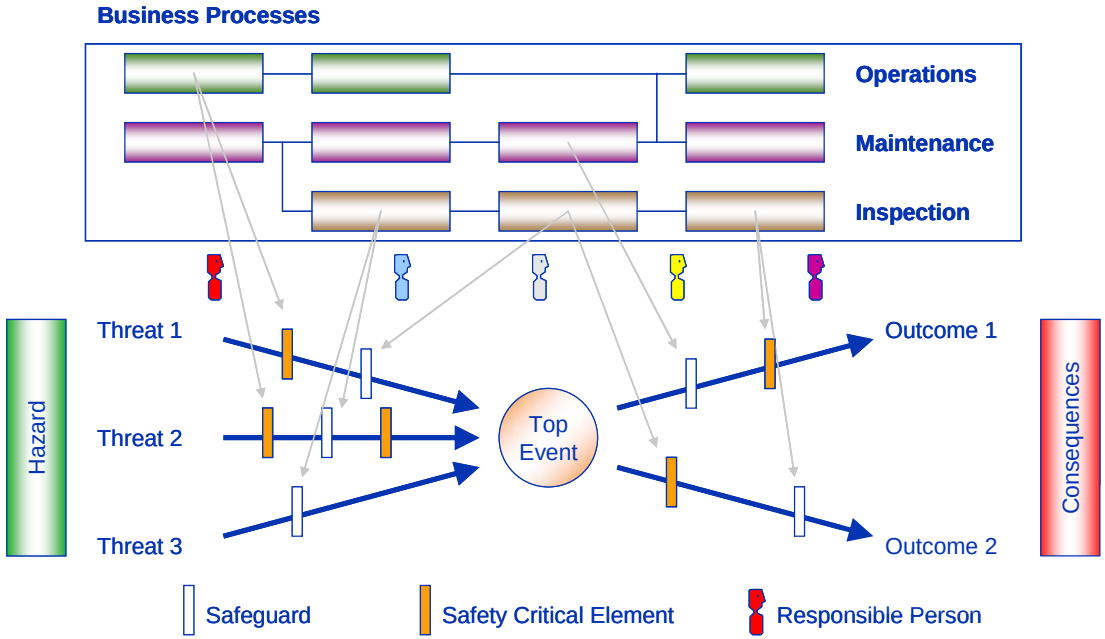
3. Fully Integrated Risk Model

- A fully integrated tool for
  - Designing for exemplary safety AND environmental performance
  - Operating for exemplary safety AND environmental performance
- Allowing for full communication between Operator, Contractor and Regulator
  - Equivalent focus on the Risk – the Controls – and the Condition
  - Transparent demonstration that safety is substantially enhanced
- Consider the use of approved, standardised tools which have been well validated



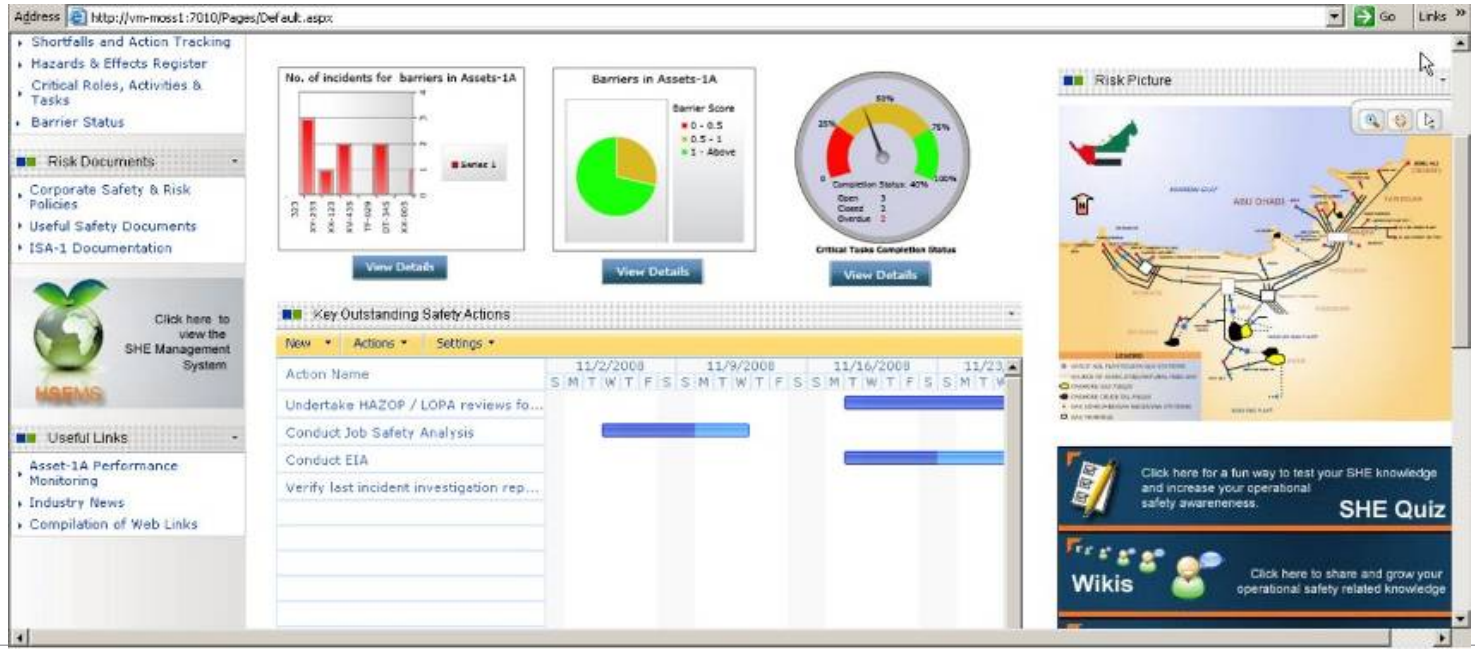
4. Clear Operational Roles and Responsibilities

- Offshore operations involve many parties
  - Owner, operator, contractors, independent 3rd parties
- The Operator owns the overall risk and the Safety case
  - The regulator may “accept” a safety case, but does not usually “approve” it
- Bow Tie risk model clearly identifies responsibilities for maintaining barriers at specified performance level



5. Shared Performance Monitoring and Decision Making

- The best risk model is still only theory if it isn't implemented
  - Technical, human and organizational means are needed to keep it REAL
  - The status of all barriers must be continuously monitored and shared with all who need to know. Teamwork should be employed for key decisions
    - Operator, Contractors, 3rd parties, regulator, and Offshore and Onshore locations
    - Decision rooms (IO) to address unusual situations or combinations of functional and degraded barriers



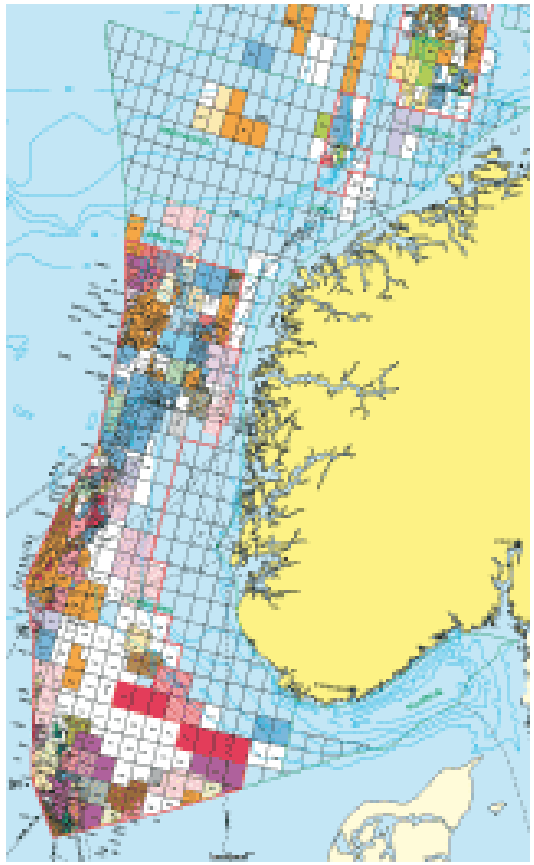
Some major changes in the regulations 1/2

- US
  - MMS broken up into three separate divisions, **the Bureau of Ocean Energy Management (BOEMRE)**, the Bureau of Safety and Environmental Enforcement, and the Office of Natural Resources Revenue,
  - BOEMRE is responsible for inspection and oversight of energy companies to ensure they are following the law and protecting the safety of their workers and the environment.
  - BOP re-certification
  - Drilling and completion plans to be reviewed by an independent professional engineer
  - Safety case on drilling rigs.
  - Development of management system requirements are under development.

- EU are looking into the need for establish safety standards in order to *Facing the challenge of the safety of offshore oil and Gas Activities*
- NSOAF (North Sea Offshore Authorities' Forum) are looking into potential weaknesses related to well control, well design and drilling systems.

Some major changes in the regulations 2/2

- Norway
  - Improvements in the organisation of the oil spill prevention and methods used
  - Continued follow up of offshore safety performance
  - No major changes in Norway related to drilling and well regulations
  - Encouraging industry to improve industry standards related to drilling and well
  - Follow closely up how the industry is able to learn from the last years incidents.



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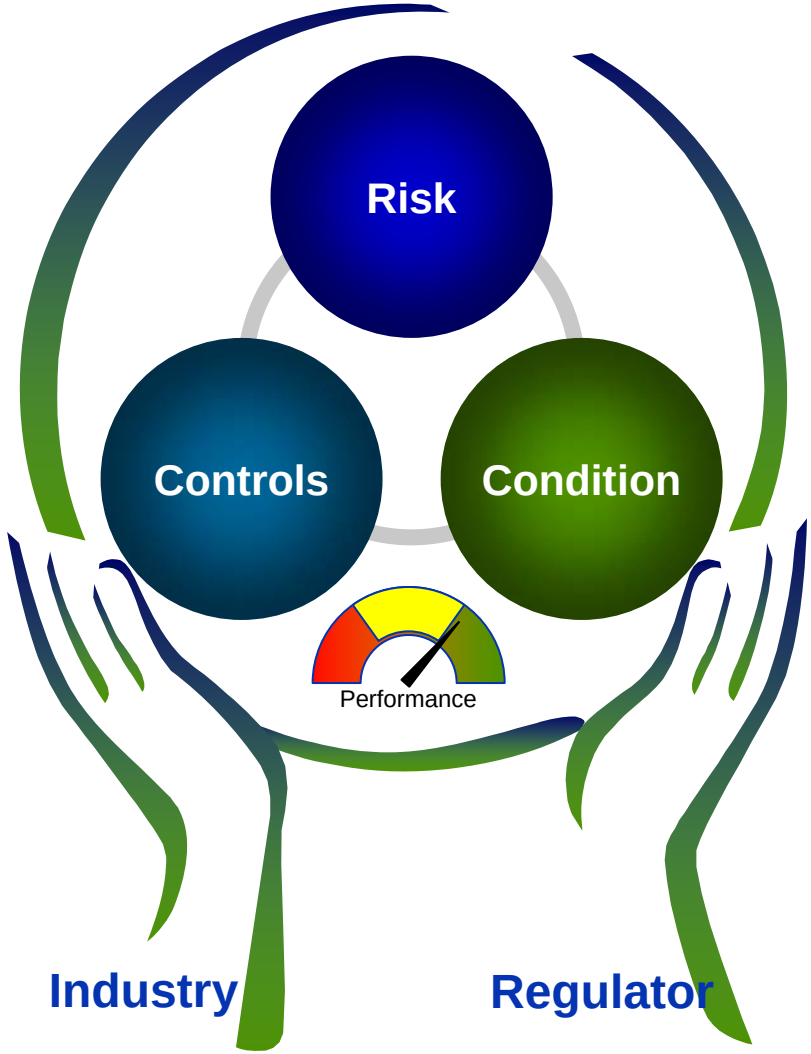
Industry initiatives

- Major Oil and Gas Operators have been updating their operational procedures after the Macondo incident.
- International Organisation for Oil and Gas Producer (OGP) and Oil and Gas UK are addressing the issue.
- ISO standard on Well Integrity is being developed
- OLF, The Norwegian Oil Industry Association has a task group which has given recommendation to improvements in industry best practices:
  - Update NORSOK D010 Well Integrity, well design, cementing, barrier testing, BOP emergency function testing
  - Update NORSOK D001 Drilling systems
  - Competence and training
  - Establish national cooperation on oil spill prevention and improved methods
  - Coordinated management of incidents

Conclusion

- The Vision – Step Change improvement for Safety and Environment
- Systematic qualification of technology and interface handling
- Improved integrated framework for risk management



Safeguarding life, property and the environment

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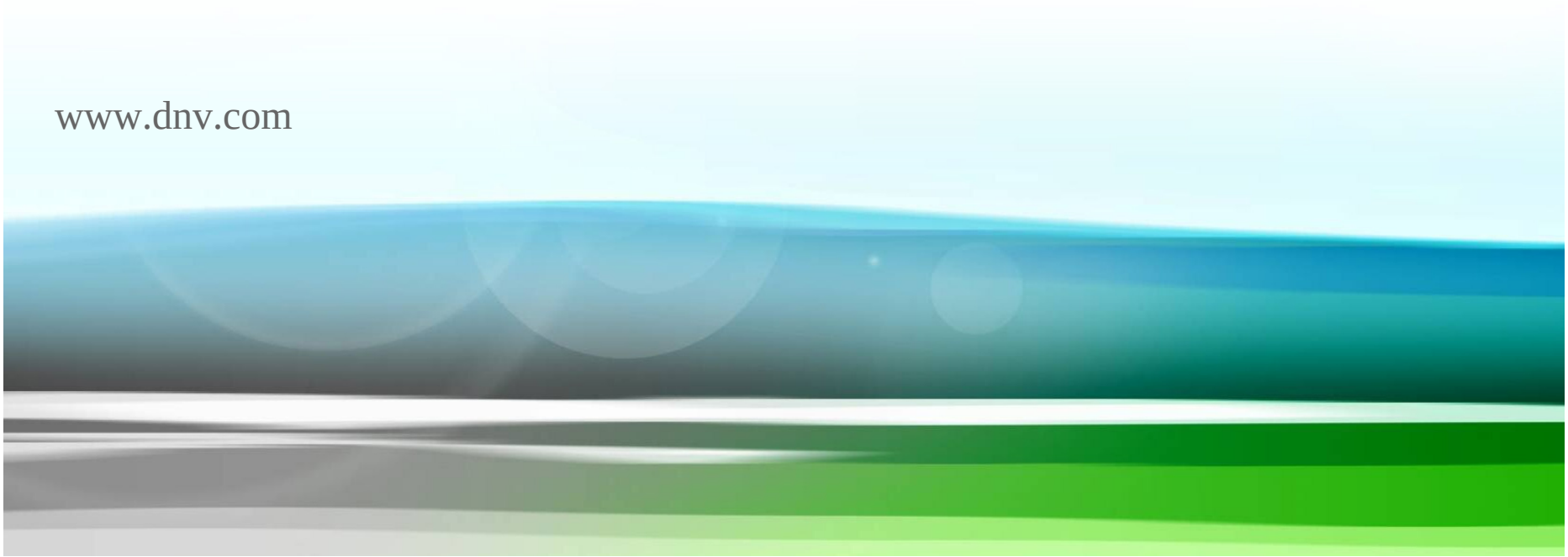

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