Managing the risk of major accidents

Transatlantic Science Week - Synergies between Space and Offshore Exploration

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Major accidents happen
We learn from them, but can we avoid them?

Three Mile Island - 1979

Alexander L. Kielland - 1980

Piper Alpha - 1988

Colombia Space Shuttle - 2003

Macondo blowout - 2010

Fukushima - 2011
Industries learn from each other …

- **1960’s**
  - Aerospace: Development of Fault and Event Tree analysis
  - Aviation: North Atlantic route separation based on Reich risk model

- **1970’s**
  - FMEA / FMECA methods developed for aerospace, automotive and military applications

- **1980’s**
  - Refining / Chemical industry start using QRA (quantitative risk assessment)
  - Risk matrix becomes widely used

- **1990’s**
  - LOPA and SIL developed (Layers Of Protection Analysis) (Safety Integrity Level)
  - Offshore O&G industry start using QRA

- **2000’s**
  - Hospitals adopt hazard identification approach for risk (termed FMEA)
  - Rail industry in Europe driven by risk standards (EN 50126, 50128, 50129)
  - LOPA and SIL developed (Layers Of Protection Analysis) (Safety Integrity Level)

- **2010’s**
Does focus on risk make improvements?
Oil & Petrochemical Industries

The industry has attained a step change improvement in **occupational safety** over the last 20 years

But no obvious improvement is seen for **major accidents** over the past four decades
Barrier Philosophy – The Swiss Cheese Safety Model

This philosophy is widely accepted as a simple model to explain risk management.

Prof James Reason (U Man)
- Developed idea of barriers using Swiss Cheese model
- Threats occur all the time (arrows)
- Controls or barriers are slices of Swiss cheese
- All barriers have some unreliability
- Holes represent barrier deficiencies
- Intuitively, the more barriers and the smaller and fewer the holes, the safer the system
“Complex systems fail in complex ways” (the Presidential Report)

Major accidents happen when several barriers of technical, human and organizational nature fail and decisions are made on weak basis.
How do regulators approach offshore safety?

- Prescriptive
  - Prescriptive and detailed regulations. However, not yet fully adopted for offshore activities.

- Performance-based
  - Performance-based approach with non-binding guidelines and recommended standards
  - Performance-based, requires the operator to demonstrate safety by a Safety Case.
  - Hybrid approach using prescriptive and performance-based requirements depending upon the circumstance
  - Mainly prescriptive regulations, often requiring industry standards through regulatory incorporation.

- A combination of performance based and prescriptive requirements is preferable
While SEMS is a prerequisite, DNV advocate additionally:

- Clear roles and responsibilities
- Active consideration of technology, people and organization in risk assessments
- Proactive identification, reduction and control of risks
- Shared performance monitoring
- Addressing rare major accidents and indicators
- Integration of safety and environmental risk for a comprehensive range of events
- Advanced barrier management
- Safety culture and new ways of working
- Emergency response
- Verification
In summary …

- Major accidents have been the drivers for change in regulatory regimes and adoption of risk management principles
- The industry has attained a step change improvement in occupational safety over the last 20 years
- We should achieve a similar step change improvement in major accidents safety through
  - a combination of performance based and prescriptive regulations and
  - adoption of advanced safety barrier management

Thanks for listening
Safeguarding life, property and the environment

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