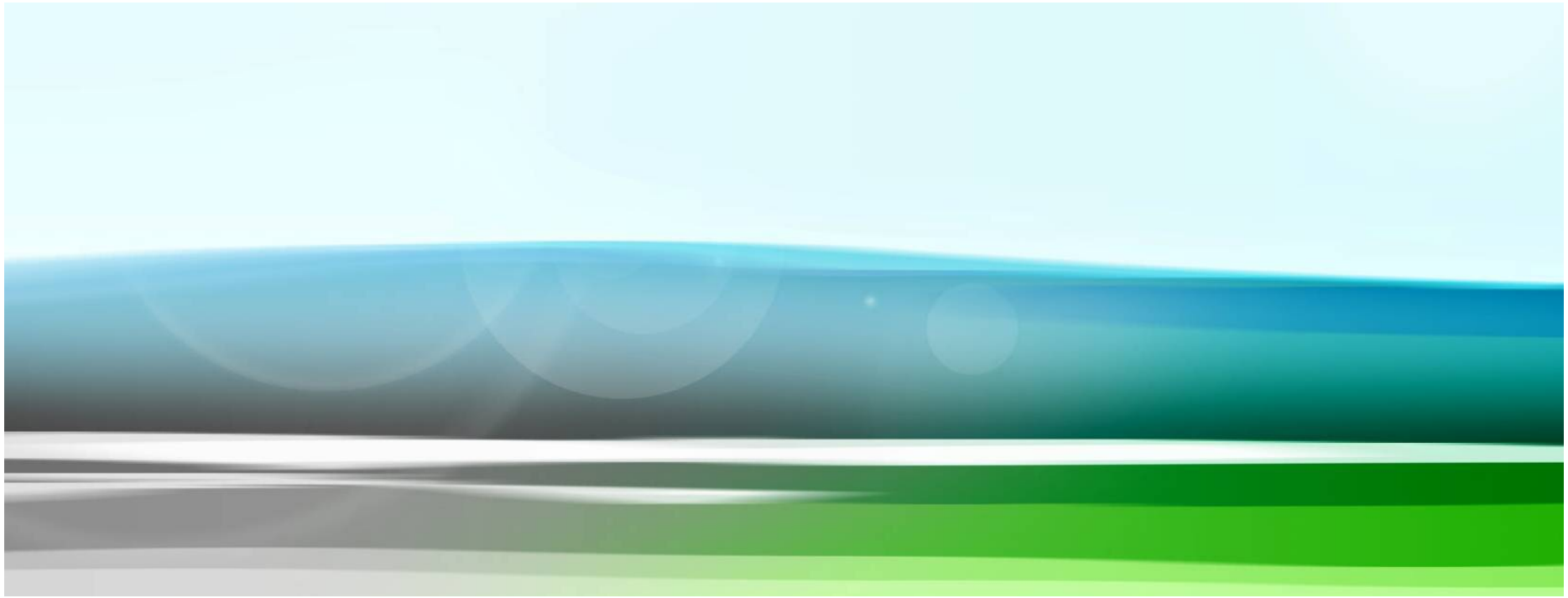


Verification of Offshore Installations

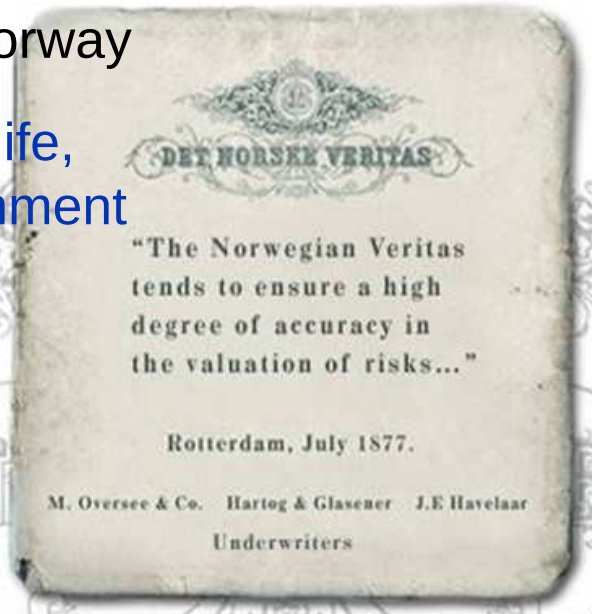
1st Offshore Protocol Working Group meeting

Siamack Atiabi
13-June-2013

MANAGING RISK DNV

DNV in brief

- established in 1864 in Norway
- objective: Safeguarding life, property, and the environment
- self-owned independent foundation



300
offices

100
countries

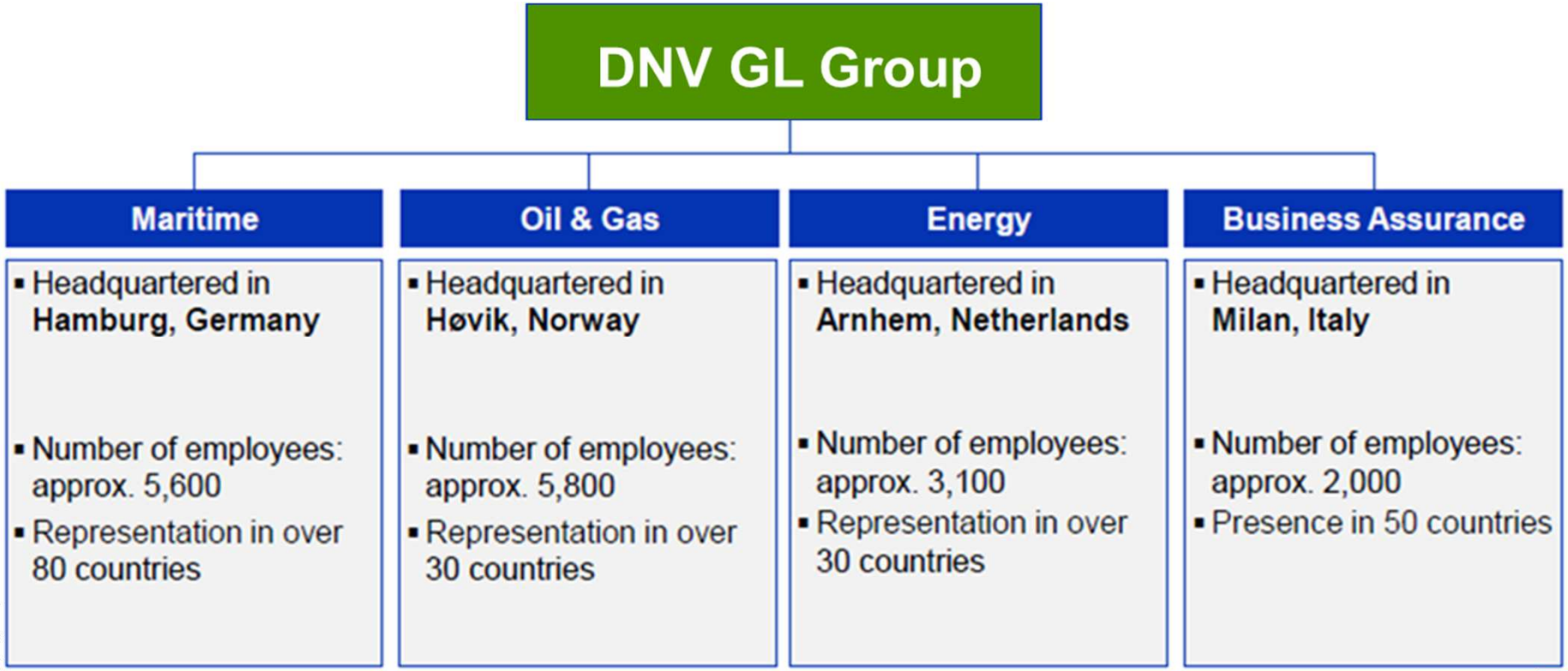
10,500
employees, of which 76% have university degree

DNV in O&G, today and tomorrow

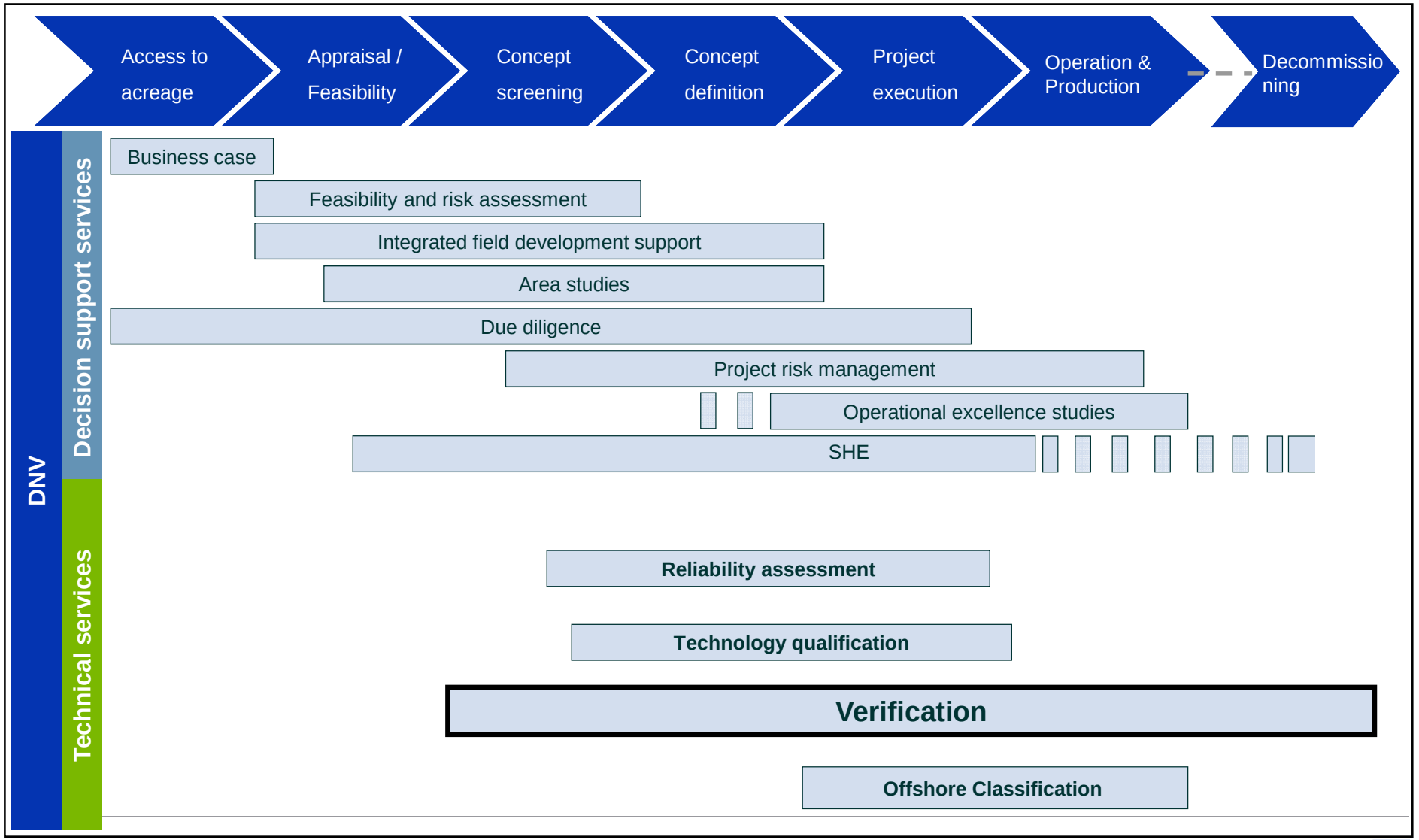
40
Years of offshore experience

2800+
Oil & Gas professionals worldwide

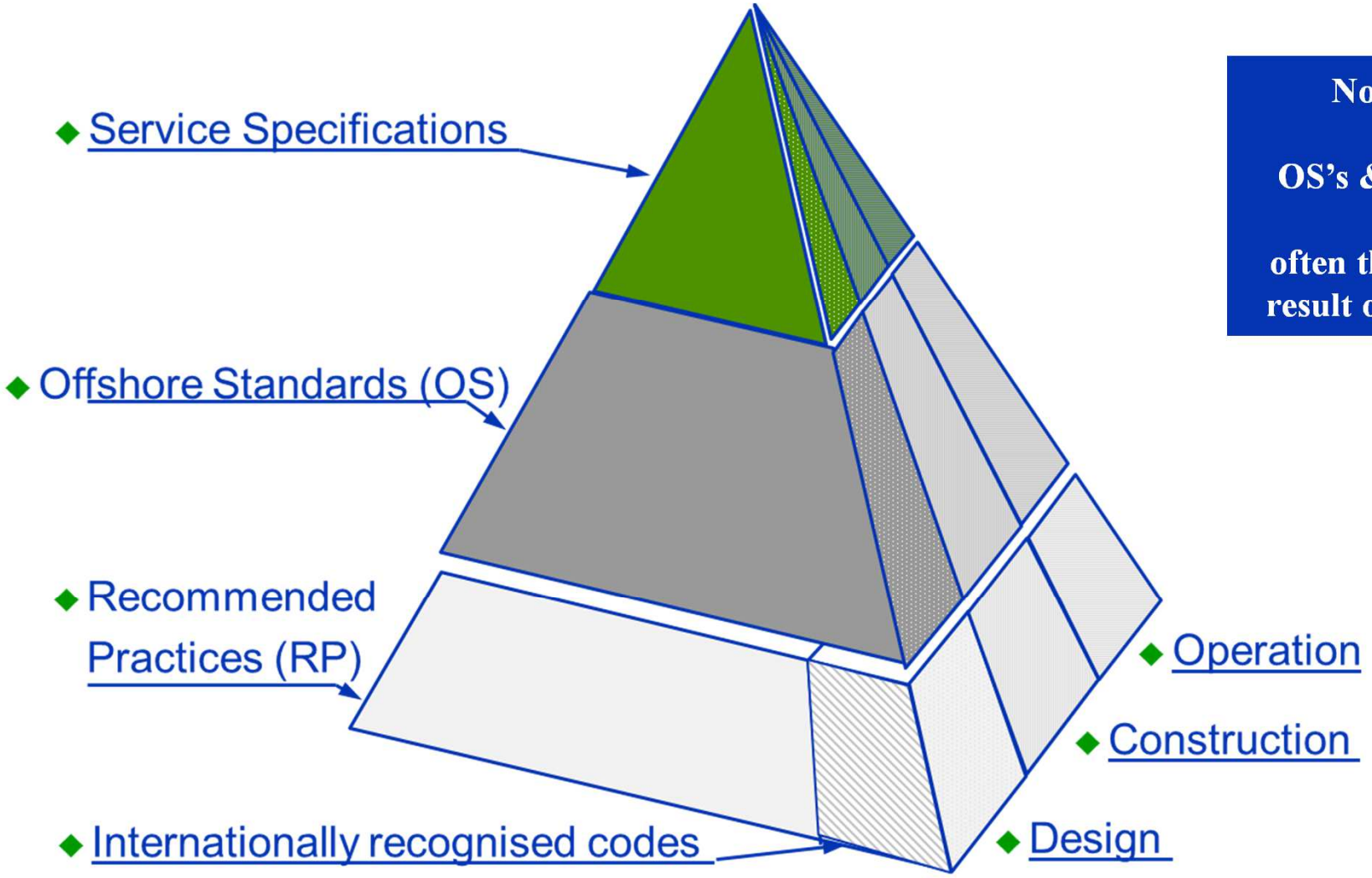
DNV
Addresses the complete value chain from exploration to decommissioning



DNV services following the field life cycle



Hierarchy of DNV Codes

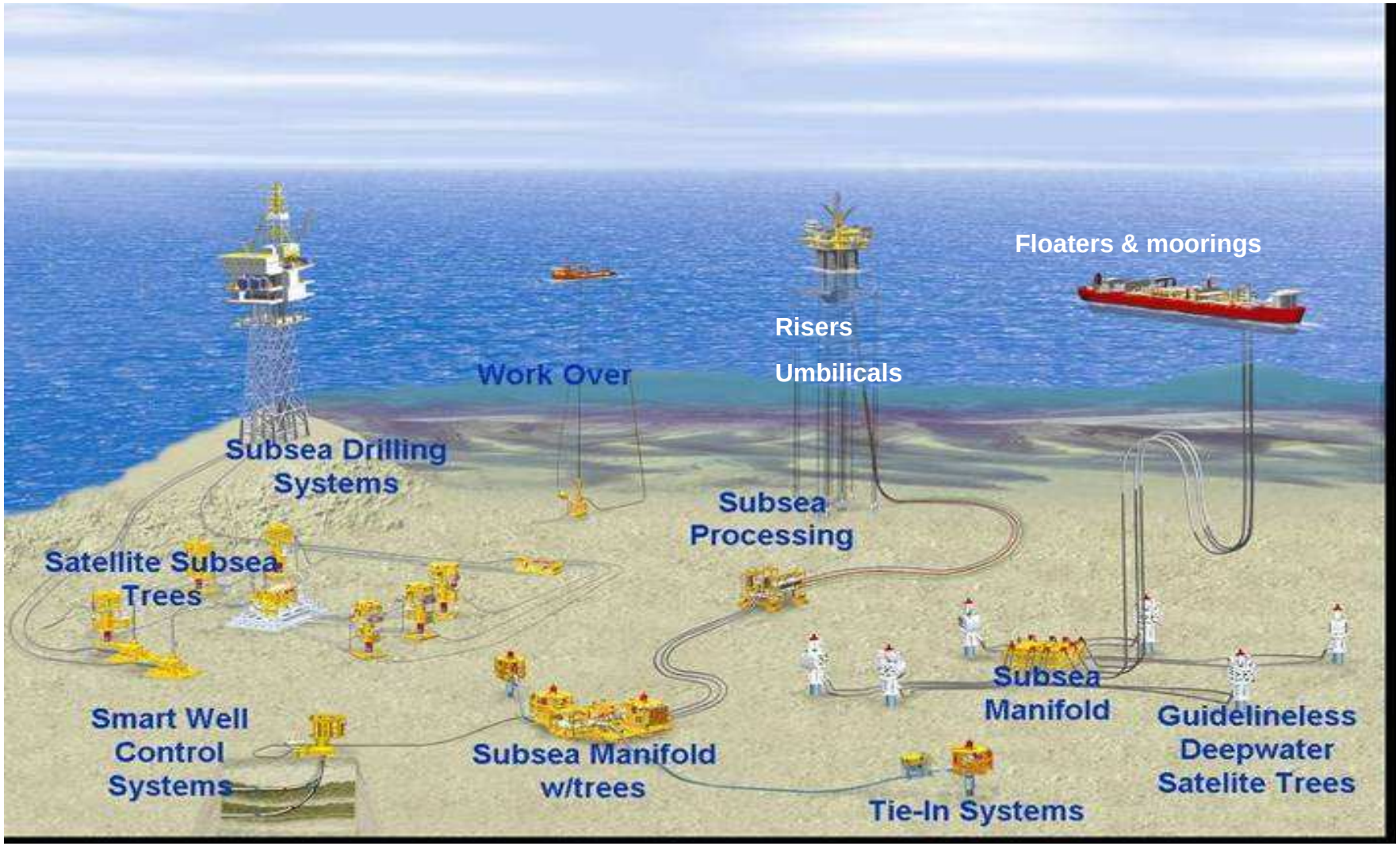


Note:

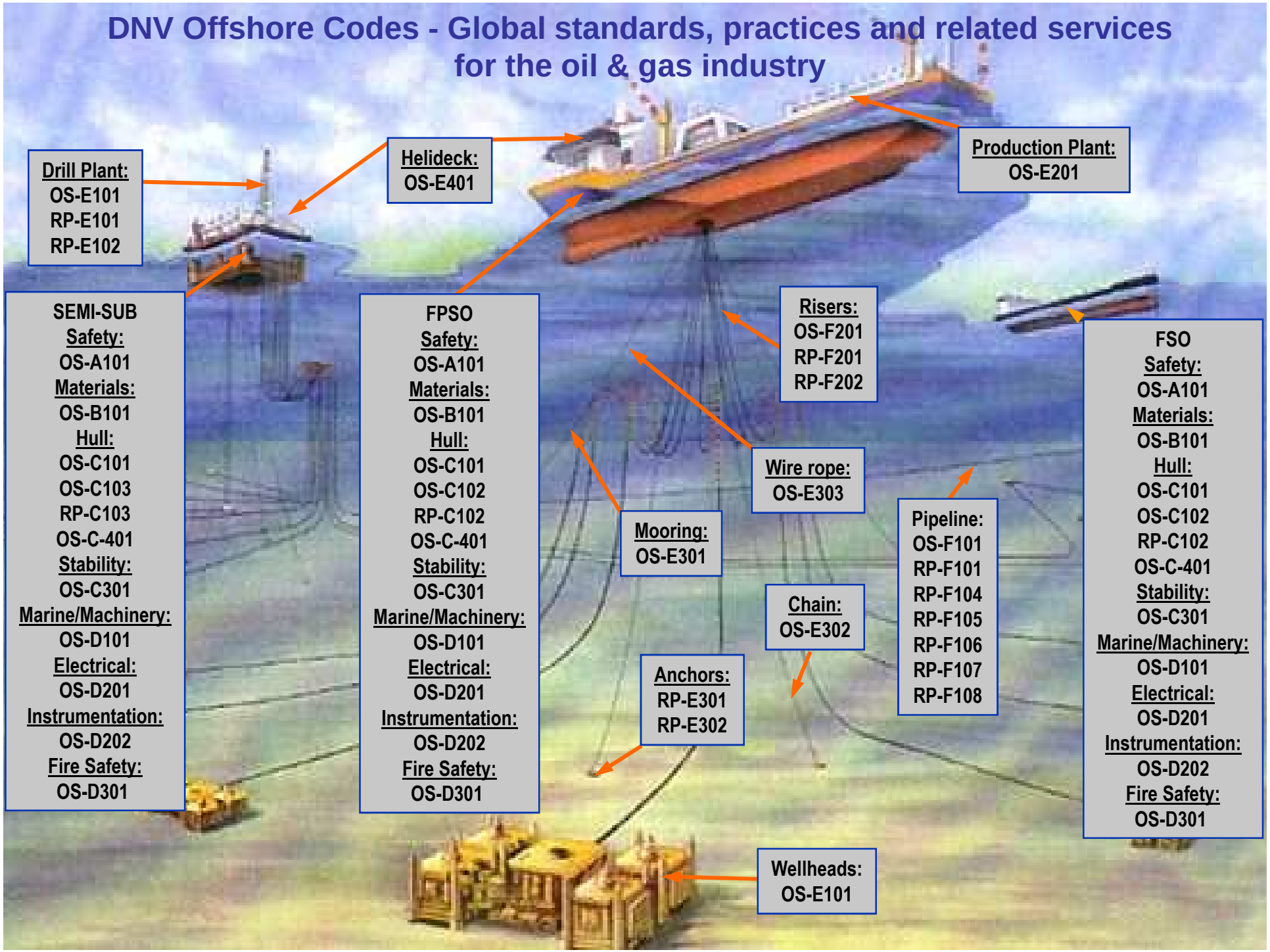
OS's & RP's

often the end result of a JIP

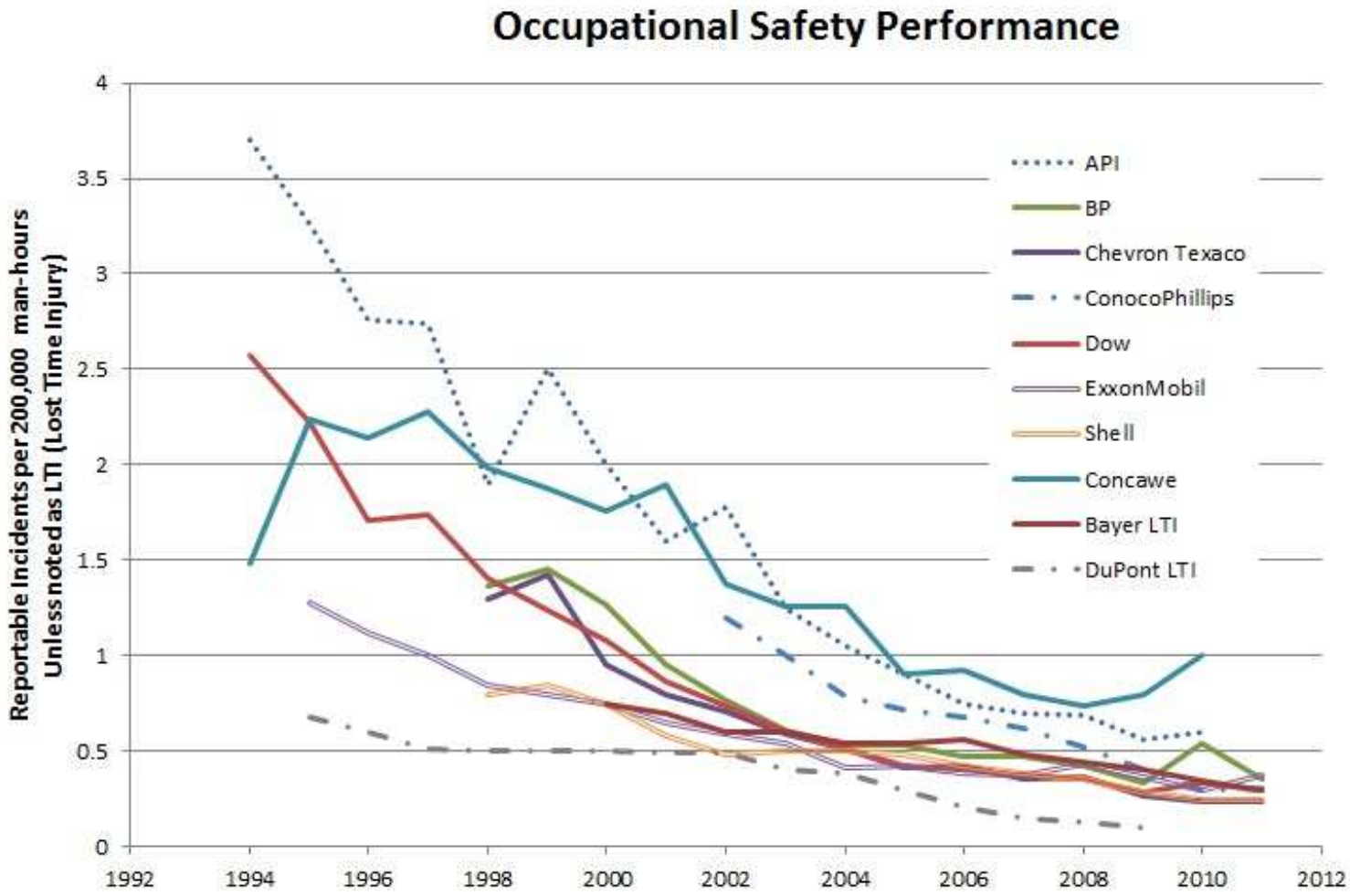
The big picture



DNV Offshore Codes - Global standards, practices and related services for the oil & gas industry



Safety Management Systems – Effectiveness Metrics
8x improvement in Occupational Safety in last 17 years



How about major accidents?

- Major accidents have been more resistant to improvement
  - Onshore: Many major accidents in 1980's 90's and 2000's
    - Toulouse, Sandoz, Antwerp, Texas City, Longford, etc.
  - Offshore: also many accidents
    - Alexander Kjelland, Piper Alpha, Macondo, Montara etc.

Development of the UK & Norway Offshore Legislations

The North Sea experience

UK and Norway adopted different safety regulations

- Both do require a focus on barriers – to be identified by risk assessment
- Safety critical elements, performance standards, and how maintained at that level

Safety results in past 25 years

- No major disasters since 1988
- Major leaks have reduced significantly in frequency
- But smaller leaks continue without much reduction – still a concern
- Challenges still happen – but when called for the safety barriers have worked and terminated incidents before they became major accidents
- This suggests the focus on risk assessment, safety barriers, performance standards and maintaining barriers, appears successful

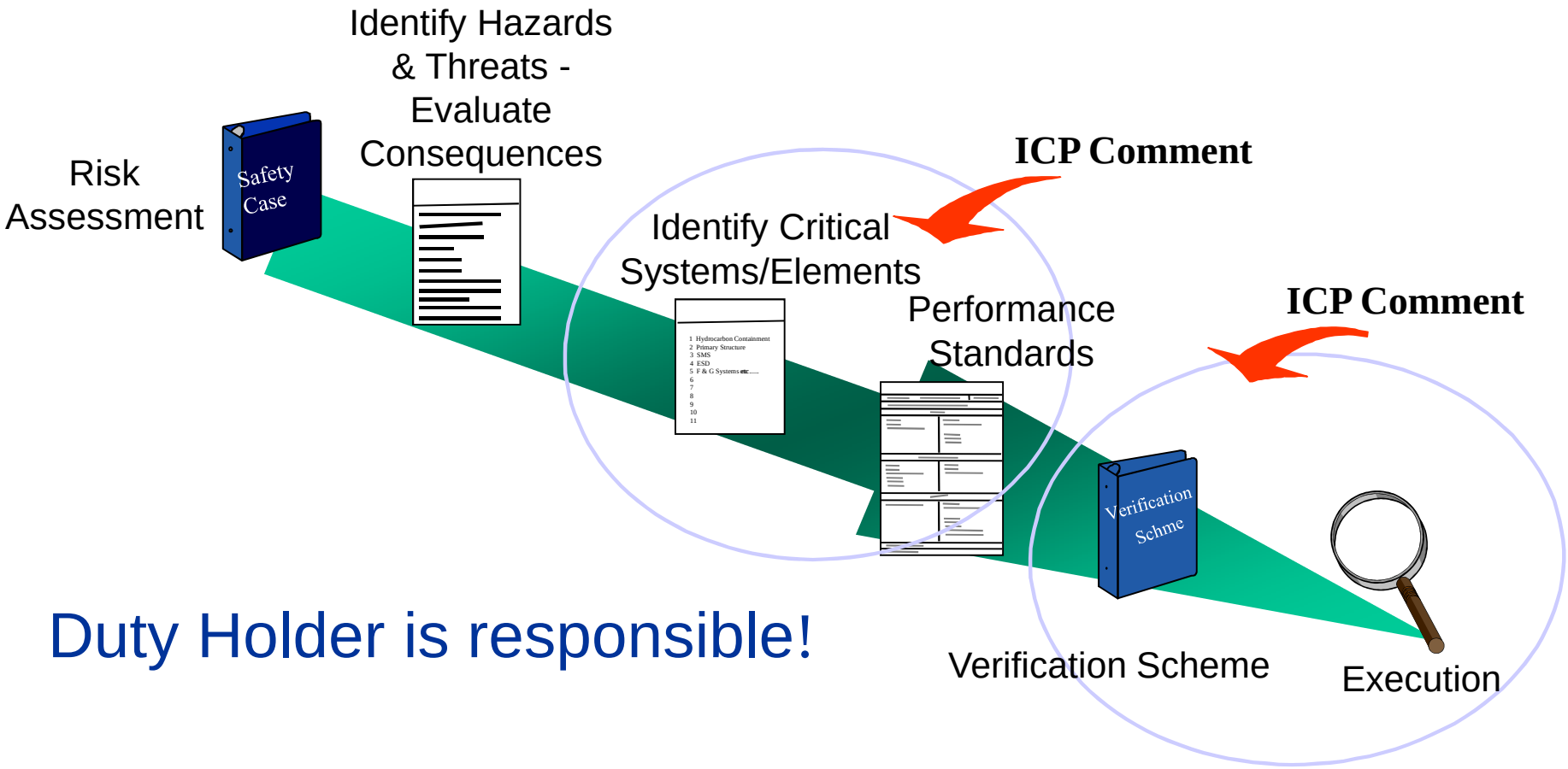
Intent of the Safety Case Regulations

The primary aim of the Regulations is to reduce the risks from major accident hazards to the health and safety of the workforce employed on offshore installations or in connected activities.

In simple terms to prevent another Piper Alpha or Aleksander Kjelland

Verification - What is it ?

An examination to confirm that an activity, a product or a service is in accordance with specified requirements



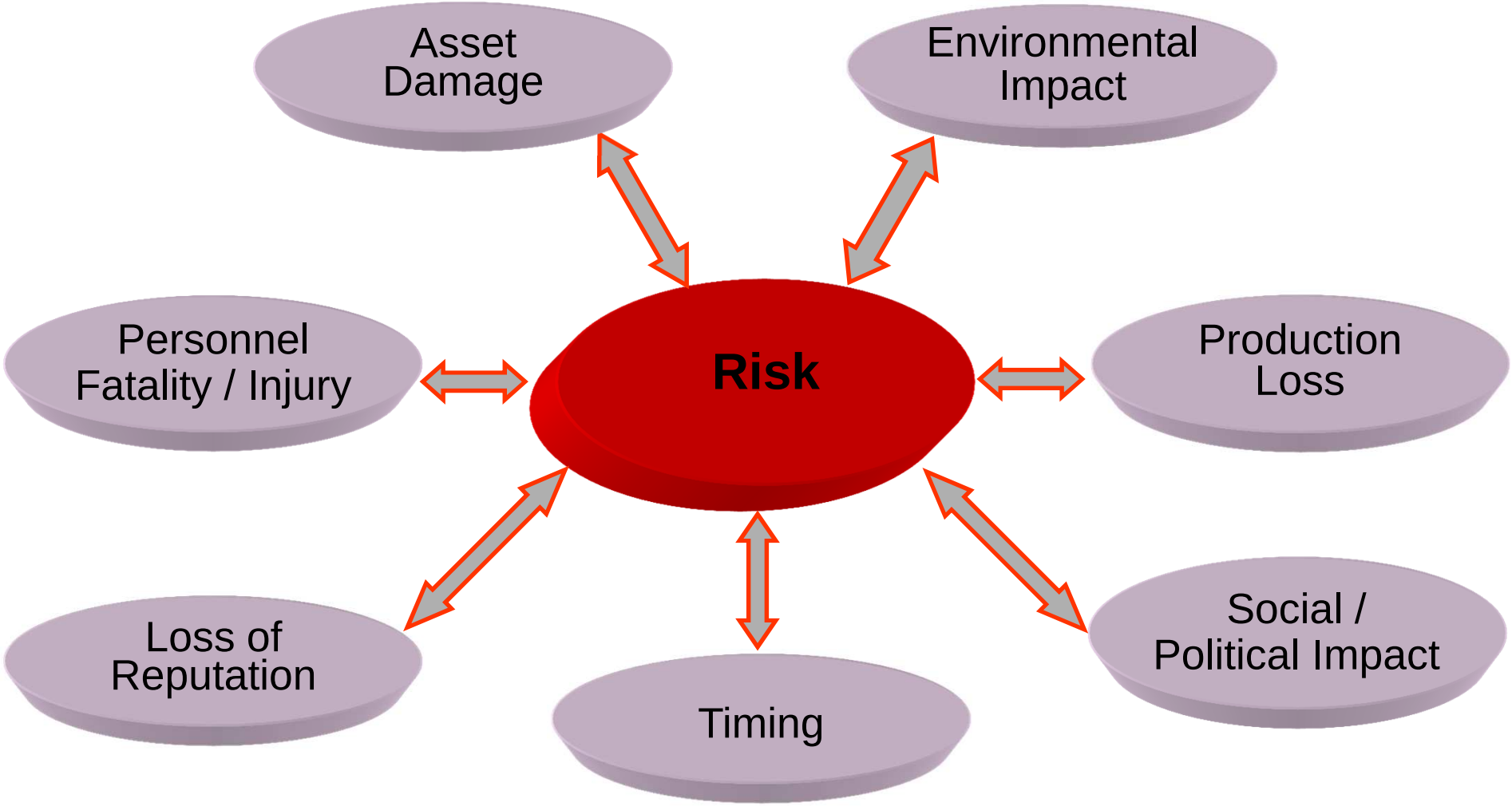
Duty Holder is responsible!

Definition of Major Accidents

Paraphrased but effectively:

- death or serious personal injury due to fire, explosion or dangerous substance release
- major damage to structure or plant, or loss of stability of the installation
- helicopter collision with structure
- failure of diving operations life support systems, detachment of a diving bell or trapping of a diver
- any event involving death or serious personal injury to 5 or more people

Verification and Risk - Types of Risk



DNV's Risk Based Verification

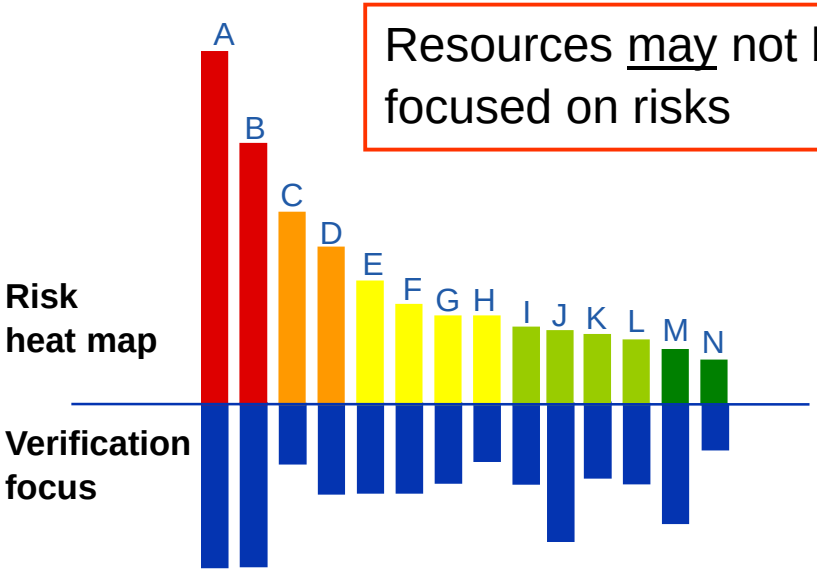
Risk Estimation
of Components A-N

Risk evaluation of
components A-N

high risk — low risk

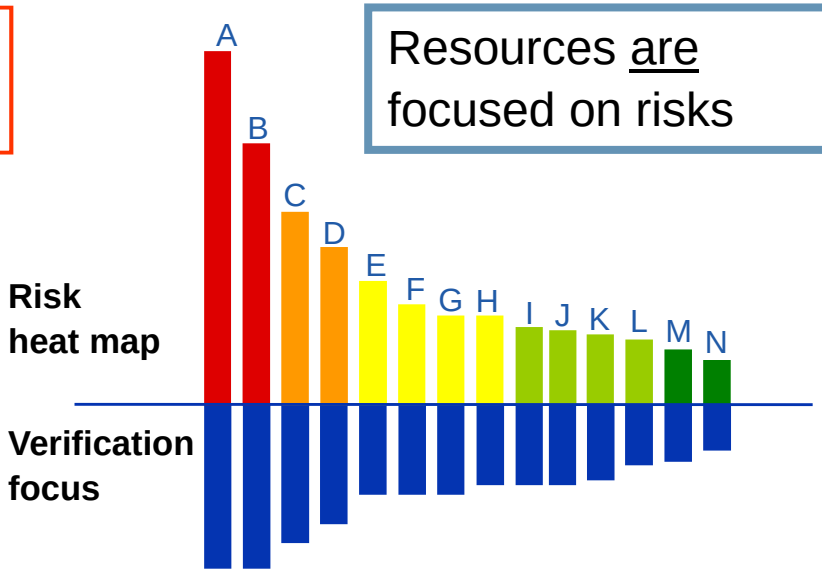
Traditional Verification

Resources may not be focused on risks



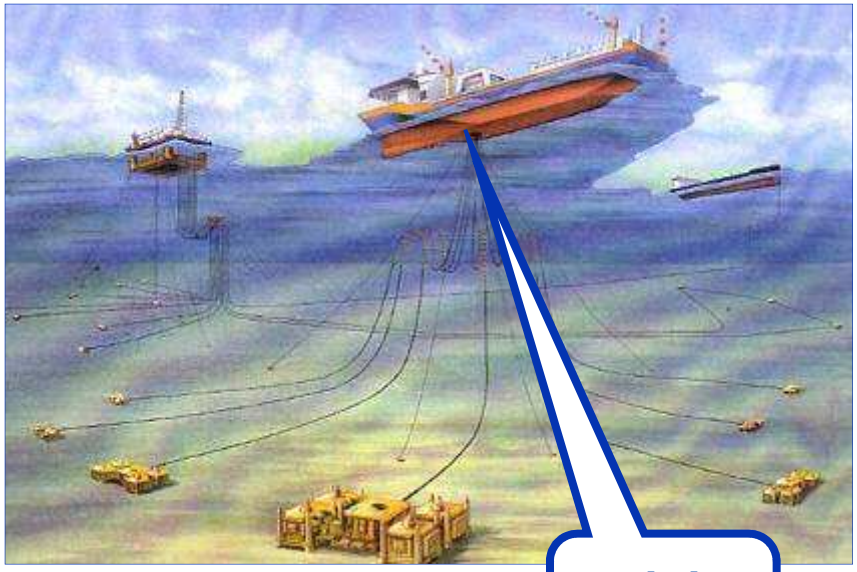
Risk-based verification

Resources are focused on risks



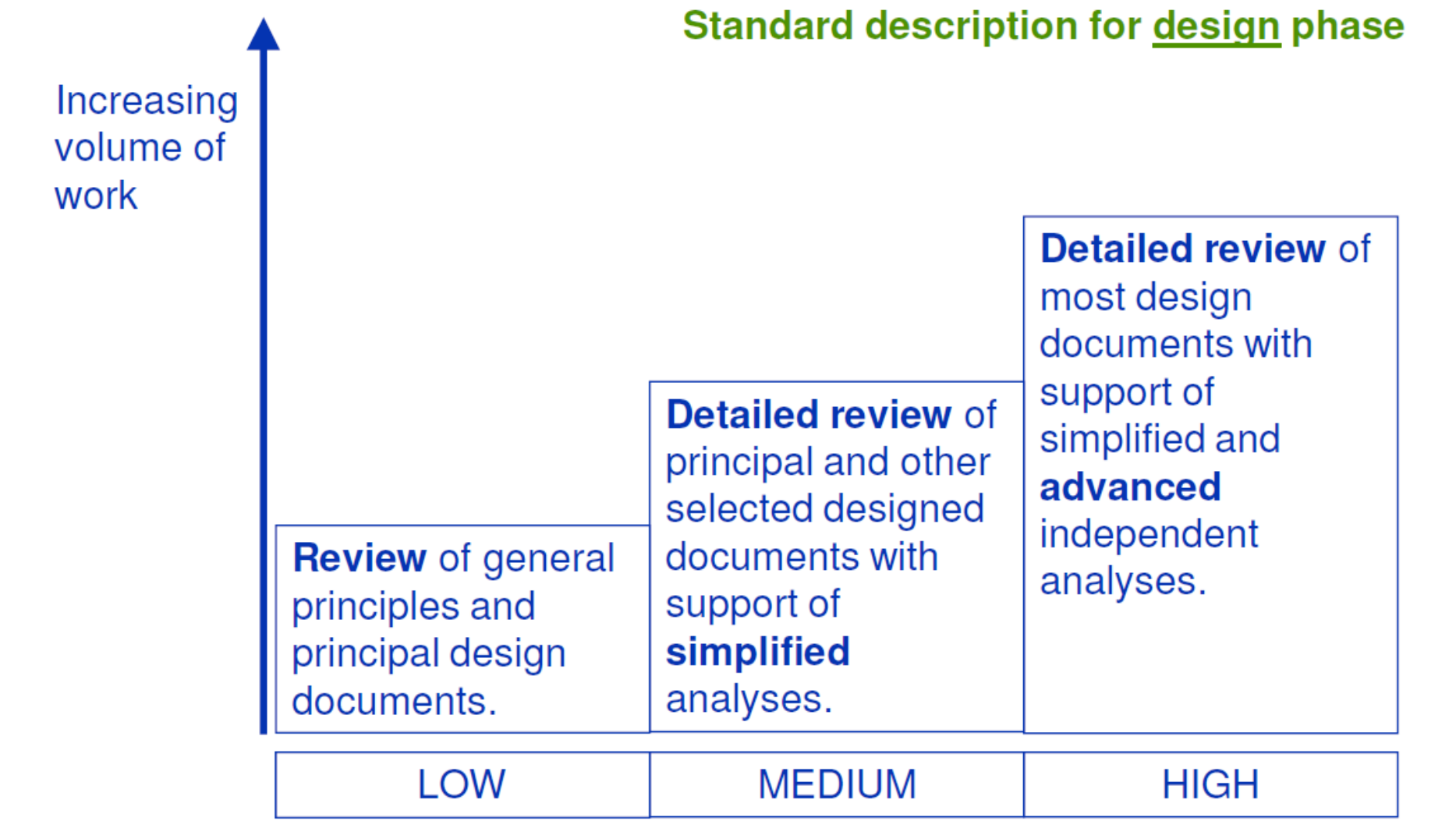
The definition of risk and risk levels

What are the critical elements of the object that needs to be verified?

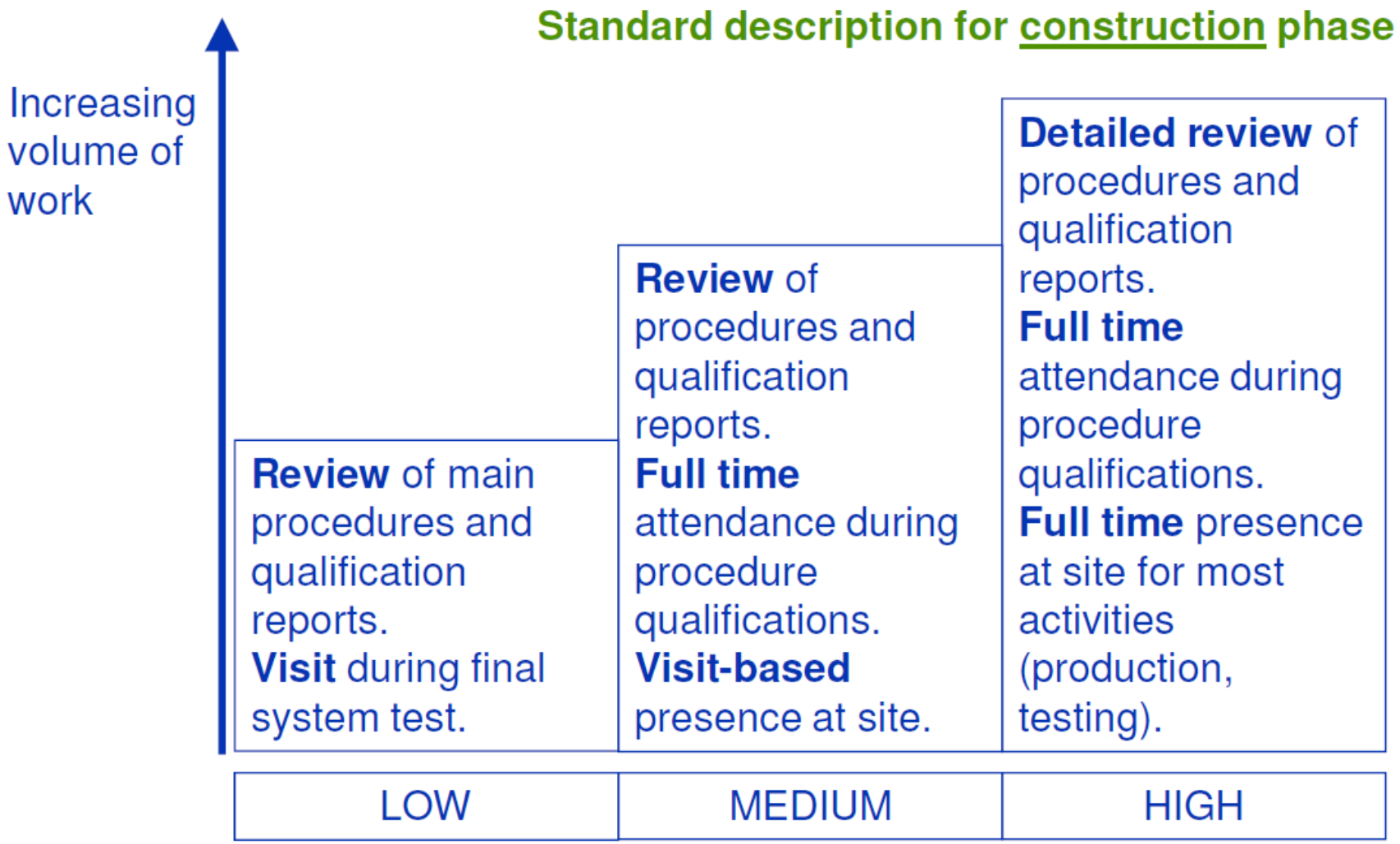


Risk = Probability x Consequence of failure

Three Tiered Verification Scope Low - Medium - High



Three Tiered Verification Scope Low - Medium - High



There is a “Food Chain” involved :

Example – Fabrication of Subsea umbilicals

Table E-1.5 Subsea control umbilicals manufacturing, sub-unit / unit and integration testing

	Description	*Level*		
		Low	*Med*	*High*
Initial activities				
1	Review quality management system	R2	R2	R2
2	Quality system audit at relevant manufacturers and sub-suppliers		A	A
3	Review of specifications and procedures			R2
4	Technical / kick-off meeting and review of manufacturers documents	R1	R1	R2
5	Verify the performance and testing during the procedure and personnel q		S1	H
Surveillance and review activities				
6	Confirm items manufactured according to specifica - review manufacturing records are in ac specifications/procedures - review non-conformance logs	R1	R2	R2
12	Confirm correct system function rticular attention to: - hydraulic fitness	S1	S3	S3
Final activities				
13	Confirm manifold/template functions by review of: - FAT records	I	R1	R2
14	Issue DNV visit / close-out report	H	H	H

Reliance KGD6 Gas & MAD6 Oil Deepwater Project

Challenge

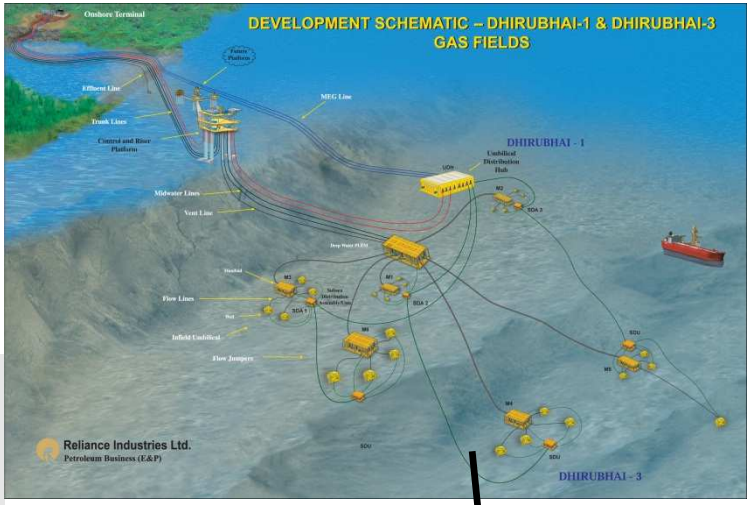
- Competence: First ultra-deep water project in the region (about 2000 m).
- Fast track green field project, 6.5 years from conceptual phase to commissioning.

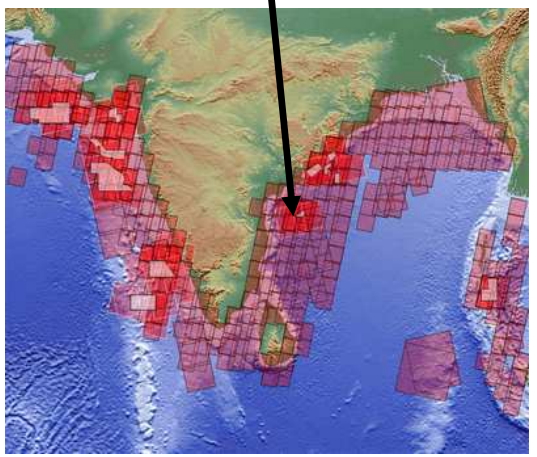
Solution

- Careful management of multi-discipline capabilities using DNV worldwide multi-discipline capabilities related to flowlines, umbilicals, templates, PLEMs, manifolds, deepwater jacket etc.
- Close project coordination among various DNV internal units.
- Use of the state-of-art DNV codes

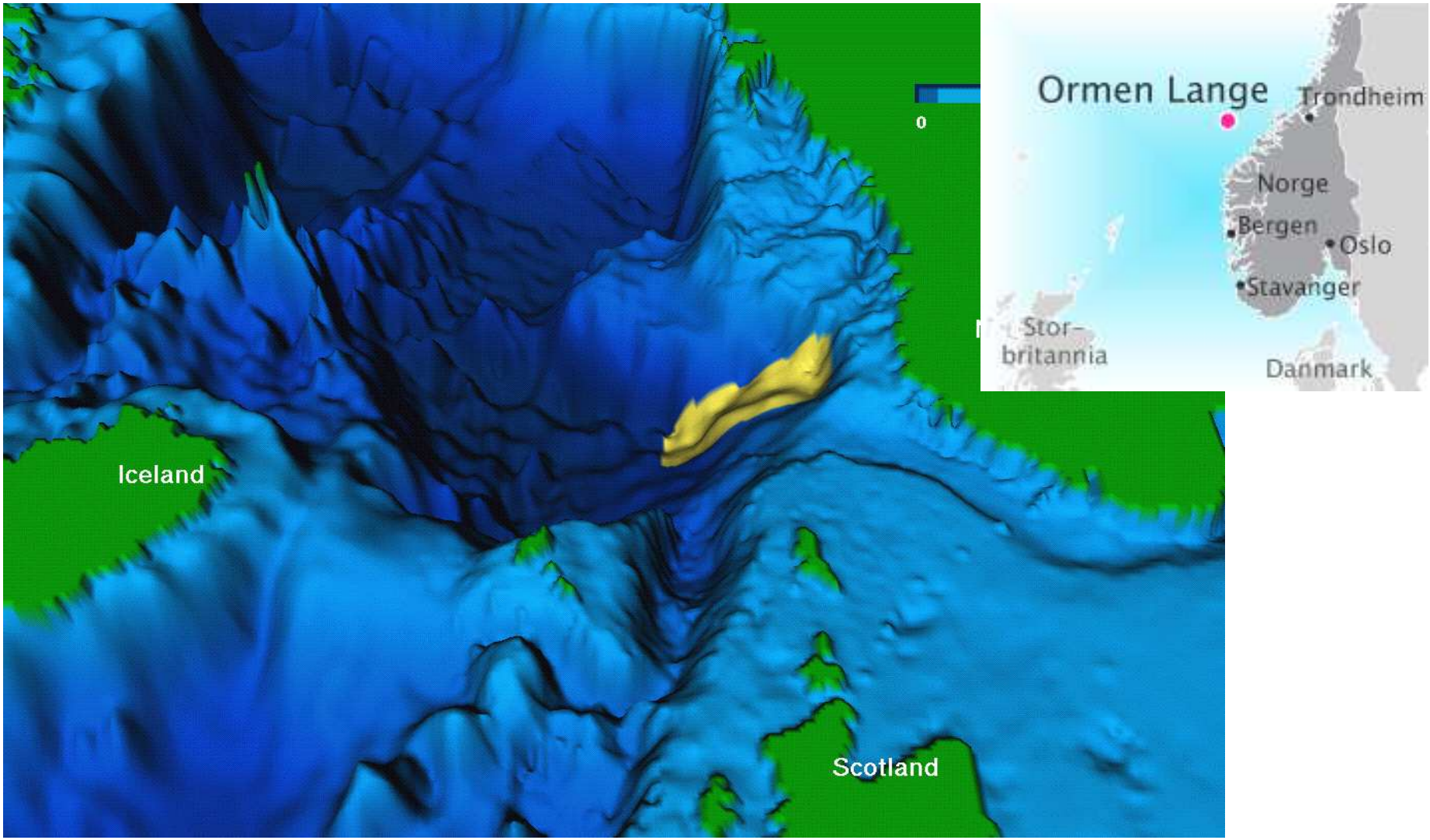
Value Delivered

- Assured Reliance of sound design, procurement, fabrication, integration and commissioning of the field

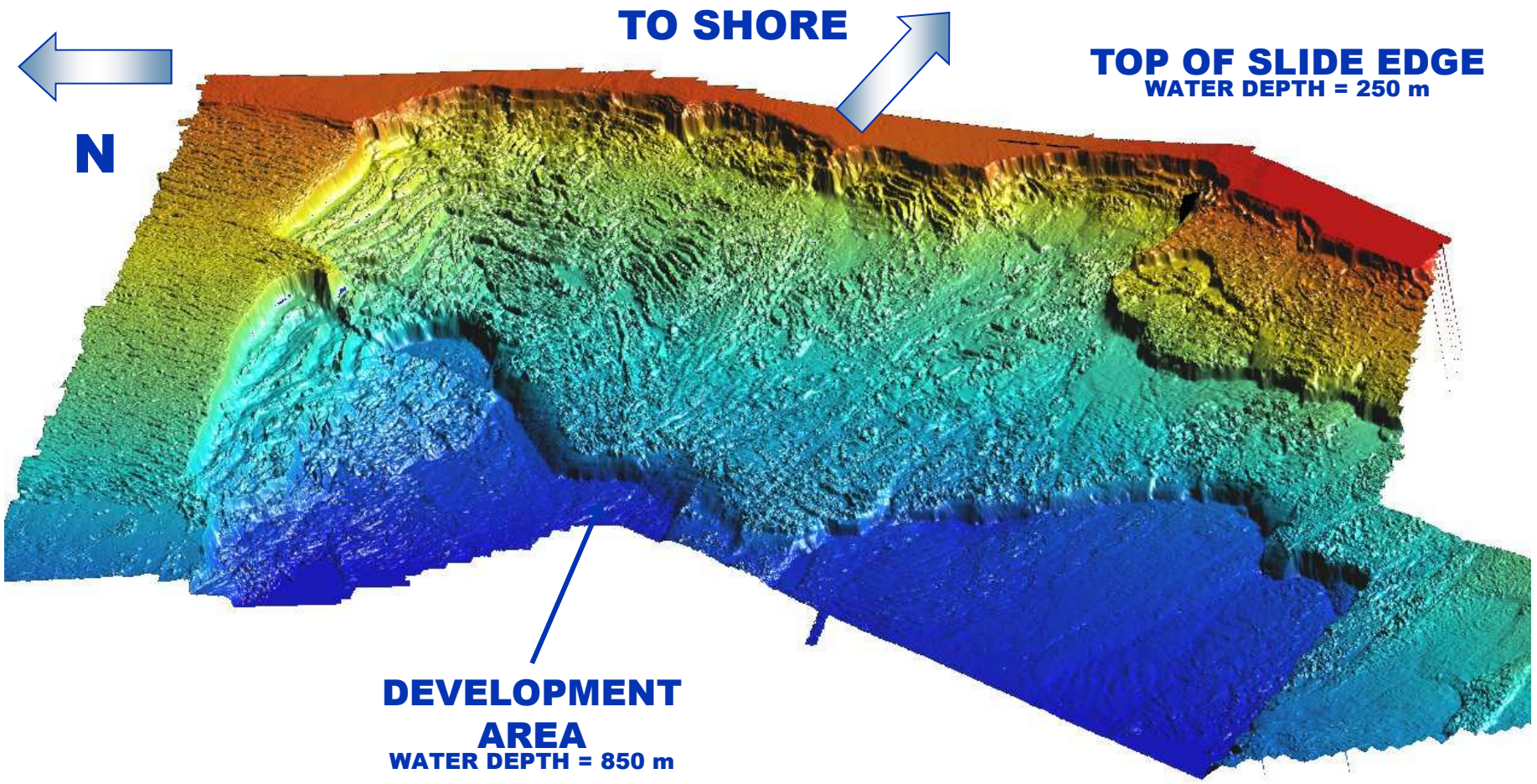




Ormen Lange: first subsea to shore development



Storegga slide area



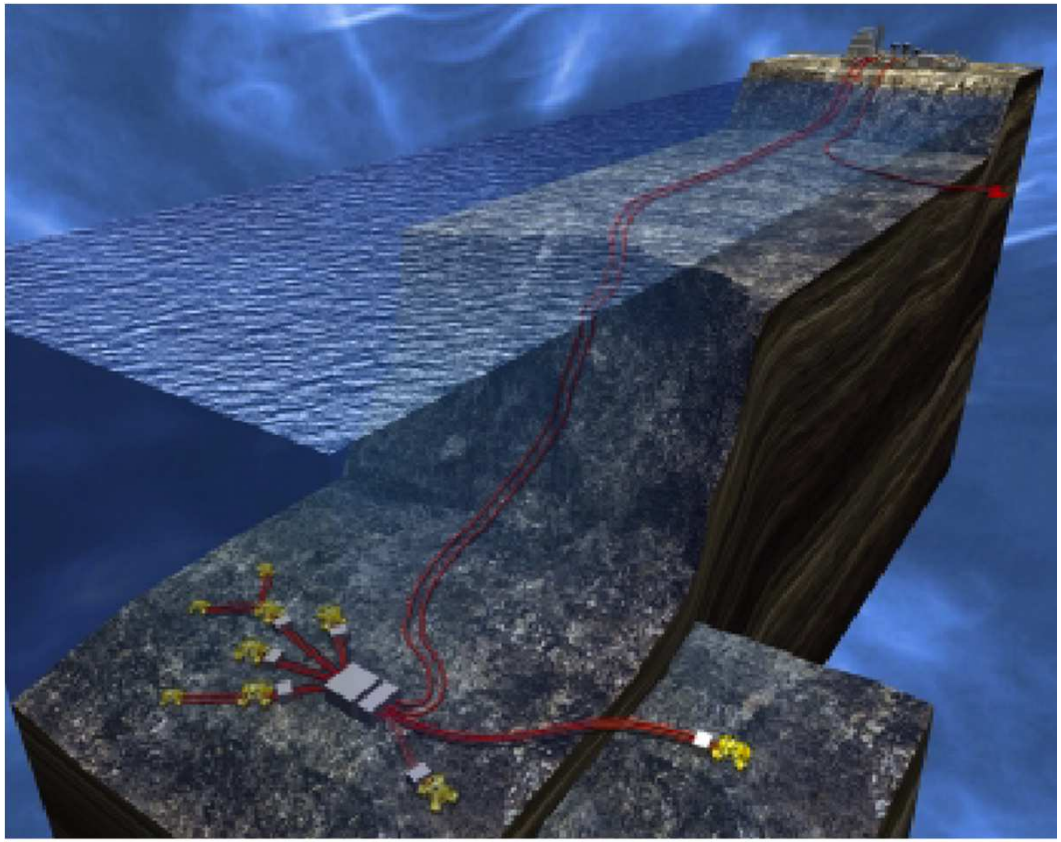
Survey coverage of the slide area

Challenges

- Very steep topography
- Long free spans
- Uneven seabed and extensive seabed preparation
- 900 m water depth
- Long tie back to shore
- Low seabed water temperature
- Flow assurance

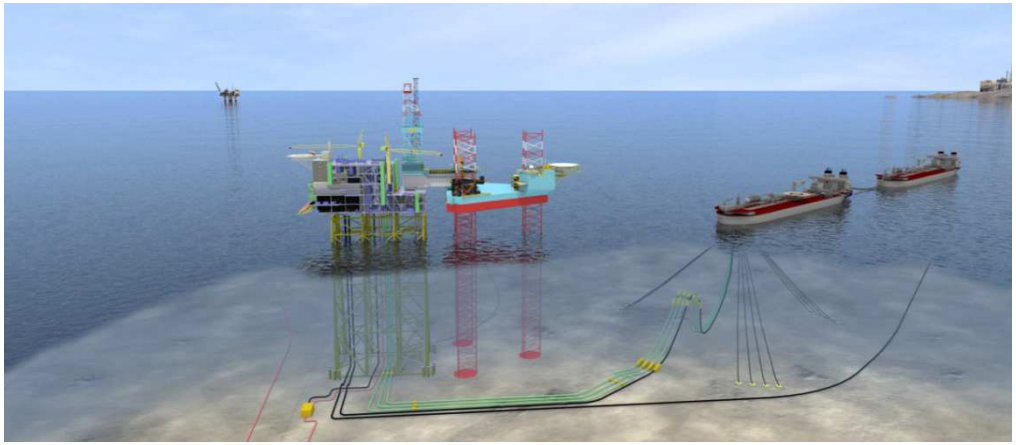
DNV role:

- Extensive Verification activities
- Qualify SN-curves → DNV fatigue tests
- VIV Model test → Project specific design guideline
- Developed Subsea Integrity Management System (SIMS)
- Qualification of down-hole safety valves according to DNV-RP-A203



Project: Martin Linge

- **Basic Engineering QRA and Safety assessment**
  - Safety barriers
  - Performance standards
- **Project Risk Manager Role**
  - Establish and maintain risk matrix
  - Develop management reports
- **Jacket design verification**
- **Cyber security assessment.**
- **Environmental Impact Assessment**
- **Review design spec for cranes** – gap analysis
- **Gap analysis design specification FSO**
  - Mooring design verification
- **Risked based verification plan top side structure**



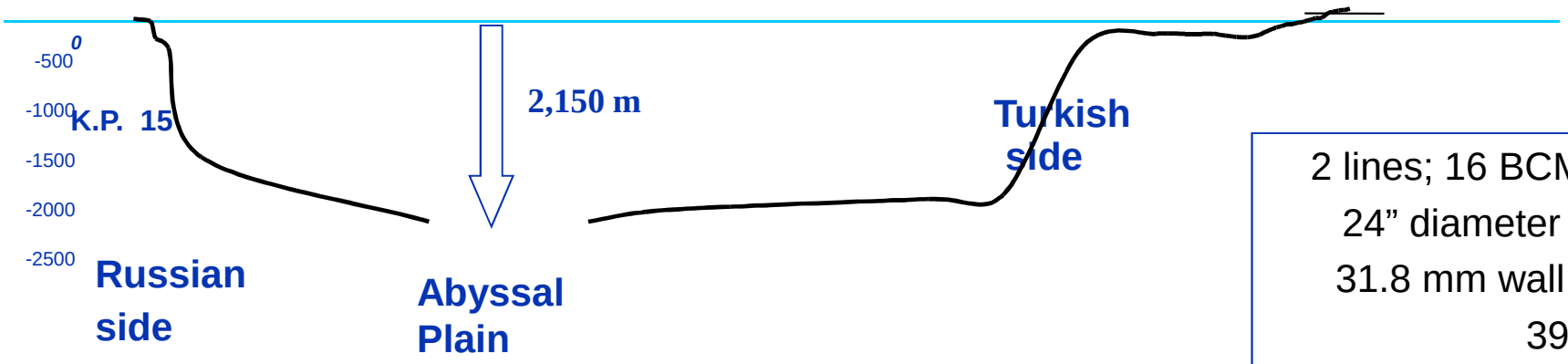
The Blue Stream - Energy needs of Turkey

- The industrialisation of Turkey
  - Historically energy needs met through
    - Gas import from Russia via Balkan pipeline
    - LNG from Algeria
    - Crude oil import
  - Natural gas consumption
    - 10BCM in 1998
    - Expected to reach 80 BCM in 2020

  Challenges:
  - Competence, financing, insurance
  - Supply reliability

The Blue Stream Pipelines

- Sediments with high levels of H2S
- Seismic activity
- Landslides and sediment flow
- Difficult topography on the Russian coastal slope (very steep sloops)
- Technological innovation
- Tight schedule
- Development of repair systems



2 lines; 16 BCM capacity
24” diameter (610 mm)
31.8 mm wall thickness
390 km long
Very deep water

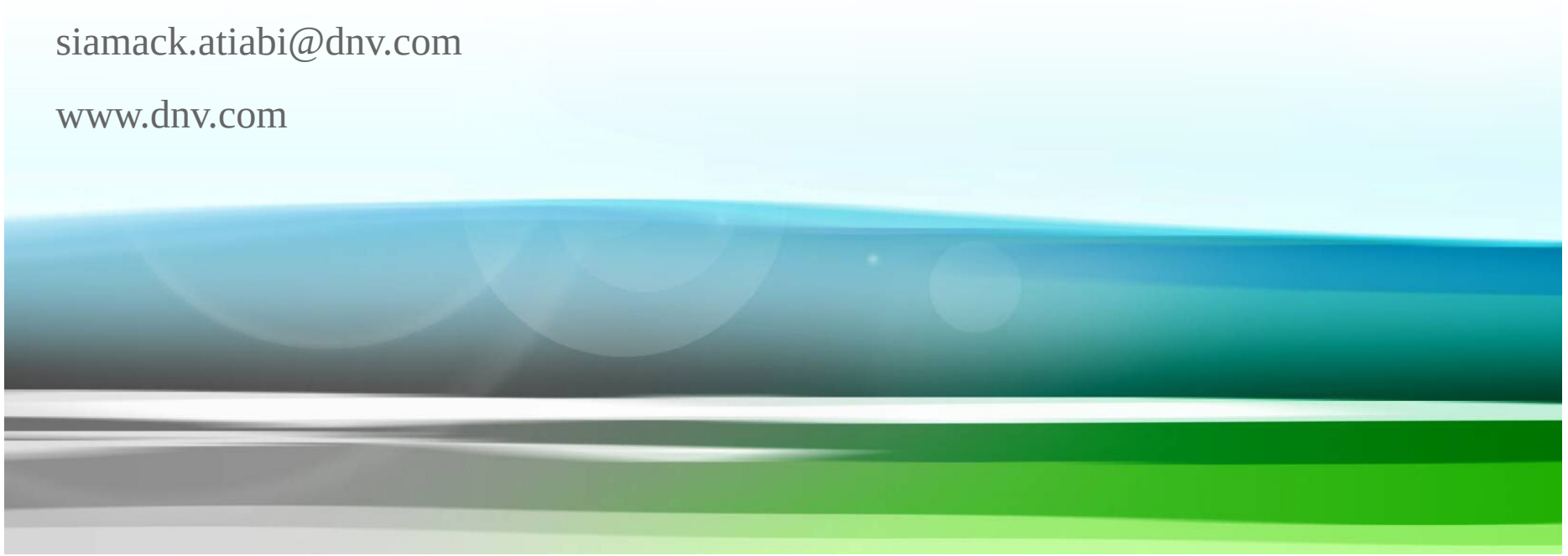
Summing up

- Authorities moving towards a goal-setting regime with functional requirements
- A transparent, global, risk-based and fully independent approach to verification, certification, quality surveillance and marine warranty is vital
- Independent verification should address an asset's entire life cycle: from concept to commissioning, operations and recycling
- Reduced and managed risk from early phases, thereby increasing the likelihood of successful project and safe operations in-service

Safeguarding life, property and the environment

siamack.atiabi@dnv.com

www.dnv.com



MANAGING RISK