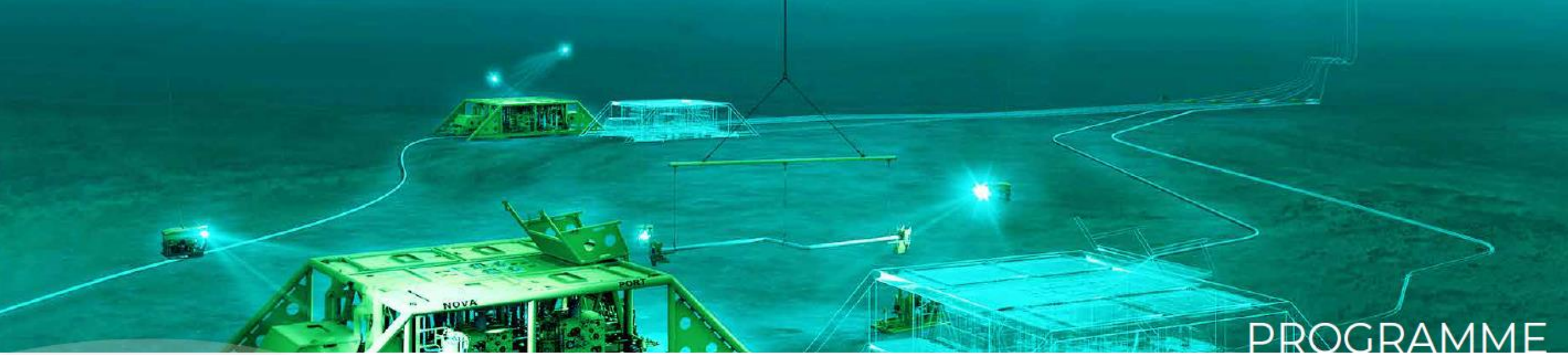


PROGRAMME

FLEXIBLE PIPES – Management of Integrity, aging, sharing of experiences and continuous improvement

PETROLEUM SAFETY AUTHORITY NORWAY

Date:	Wednesday 4th December 2019
08.30-09.00	Registration
09.00-09.20	**Introduction and background** Petroleum Safety Authority
09.20-09.55	**Integrity Management of Bonded Flexible Pipes** 4Subsea
09.55-10.25	**Technology qualification of flexible pipes based on learnings from previous failures** DNVGL
10.25-10.45	Coffee break
10.45-11.15	**Flexible pipes - Corrosion of Armour Wires in Annulus** IFE
11.15-11.45	**Oda flexible water injection pipeline experience** Spirit Energy
11.45-12.30	Lunch
12.30-13.00	**Goliat bonded offloading hose; Integrity management, inspection, experience transfer and learning** Vår Energi
13.00-13.30	**Flexible Pipe Integrity Assessment: An Alvheim Case Study** AkerBP
13.30-13.45	Coffee break
13.45-14.15	**Methods for calculating Fatigue Stresses in Flexible Pipes – An Overview** NTNU
14.15-15.00	**Offshore offloading hoses – Inspection, maintenance and findings; Flexible risers – Corrosion and corrosion fatigue learnings** Equinor
15.00-15:20	**Flexible Pipe Integrity Management since Sureflex, and introducing the Energy Institute draft guidelines for life extension** Wood
15.20	Summing up and closing.

Overall goals

“The Petroleum Safety Authority Norway will set the terms for supervising that the players in the petroleum sector maintain a high standard for health, safety, the environment and emergency preparedness, and thereby also contribute to creating the greatest possible value for society.”

The Petroleum Act 29 defines petroleum activities as:

“..all activities associated with subsea petroleum deposits, including exploration, exploration drilling, production, transportation, utilisation and decommissioning, including planning of such activities..”

White paper (April 2018) - Health, safety and environment in the petroleum industry

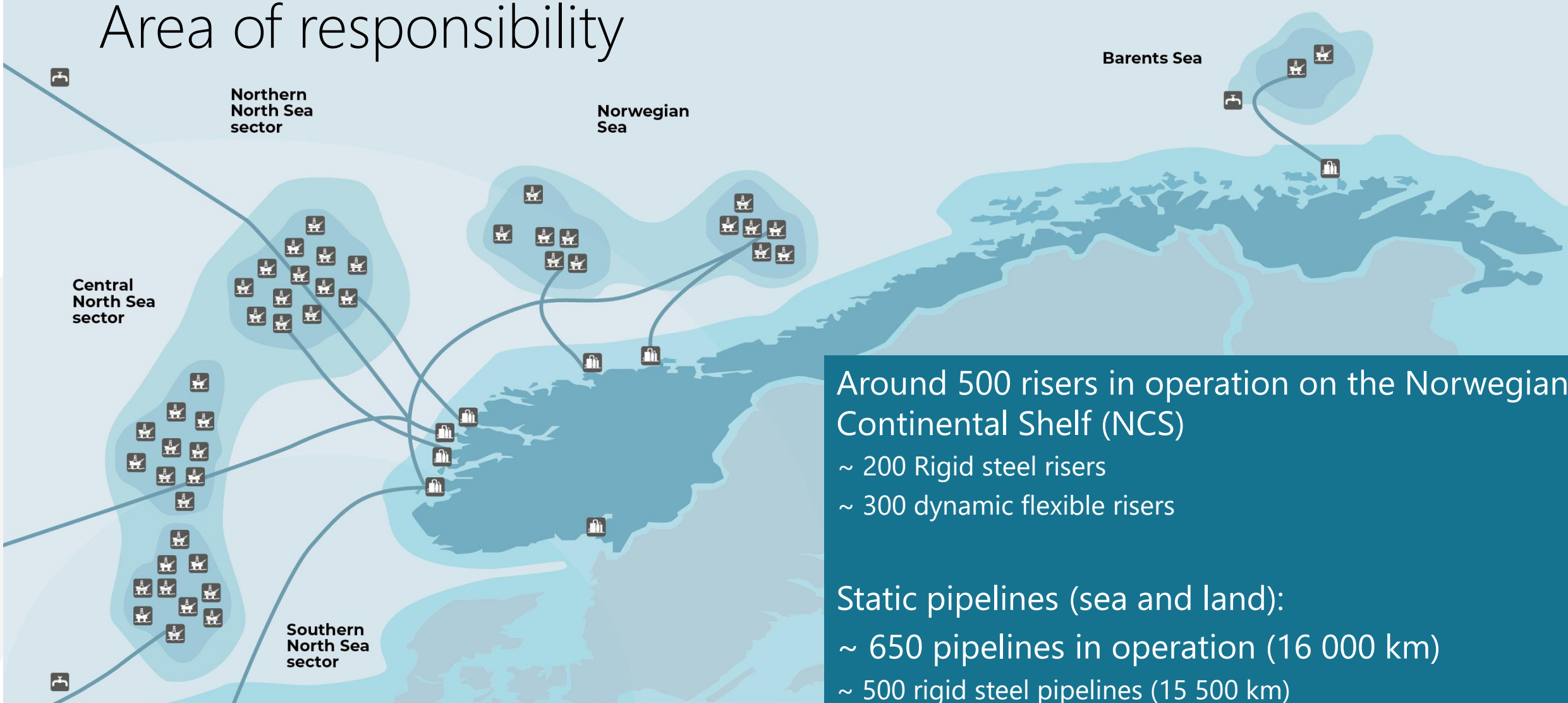
The Government's ambition is that the Norwegian petroleum activities shall be world leaders when it comes to HSE

The companies are responsible for the HSE level in the petroleum activities. The authorities' follow-up comes in addition to, and not as a replacement for, the companies' own follow-up.

Generally, the authorities and parties consider the current HSE regime to be robust and well-functioning and believe it should be continued.

Link to white paper

Area of responsibility



Around 500 risers in operation on the Norwegian Continental Shelf (NCS)

~ 200 Rigid steel risers

~ 300 dynamic flexible risers

Static pipelines (sea and land):

~ 650 pipelines in operation (16 000 km)

~ 500 rigid steel pipelines (15 500 km)

~ 150 static flexible pipelines (500 km)

~ several hundred flexible tails and jumpers

Our follow-up activities

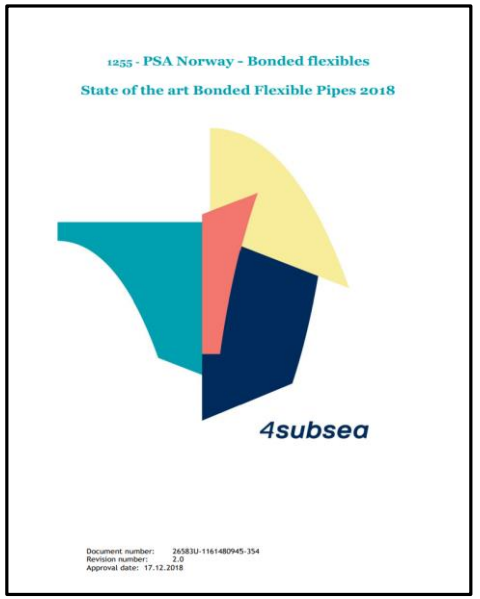
- Status meetings with operating companies, suppliers
- Supervisory activities (audits) with design, fabrication and operation
- Follow-up and investigations of incidents
- Publications and Reports, Seminars, Trends in risk level (RNNP)
- Industry reports (learning and sharing of experiences)
- Co-operation with other authorities
- Network meetings, JIPs
- Participation in standardisation groups


DNV·GL

Subsea Facilities - Technology Developments, Incidents and Future Trends

Petroleumstilsynet

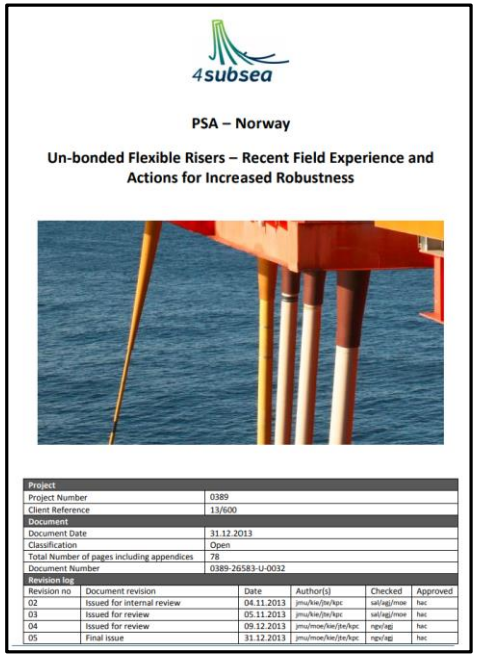
Report No.: 2014-0113, Rev. 03
Document No.: 18IM1UH-4
Date: 14.03.2014


1255 - PSA Norway - Bonded flexibles

State of the art Bonded Flexible Pipes 2018

4subsea

Document number: 26583U-116148094S-354
Revision number: 2.0
Approval date: 17.12.2018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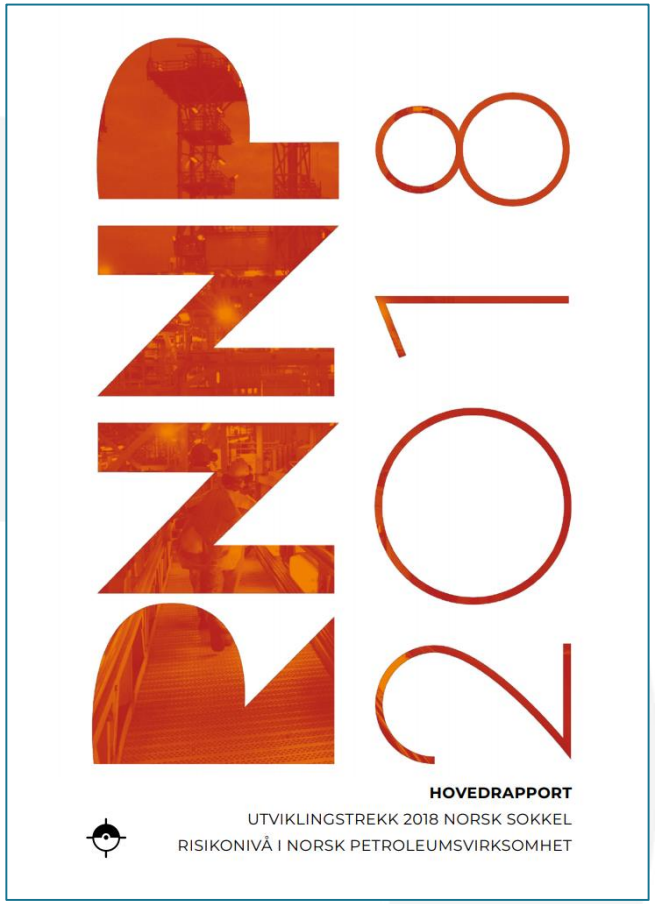
PSA – Norway

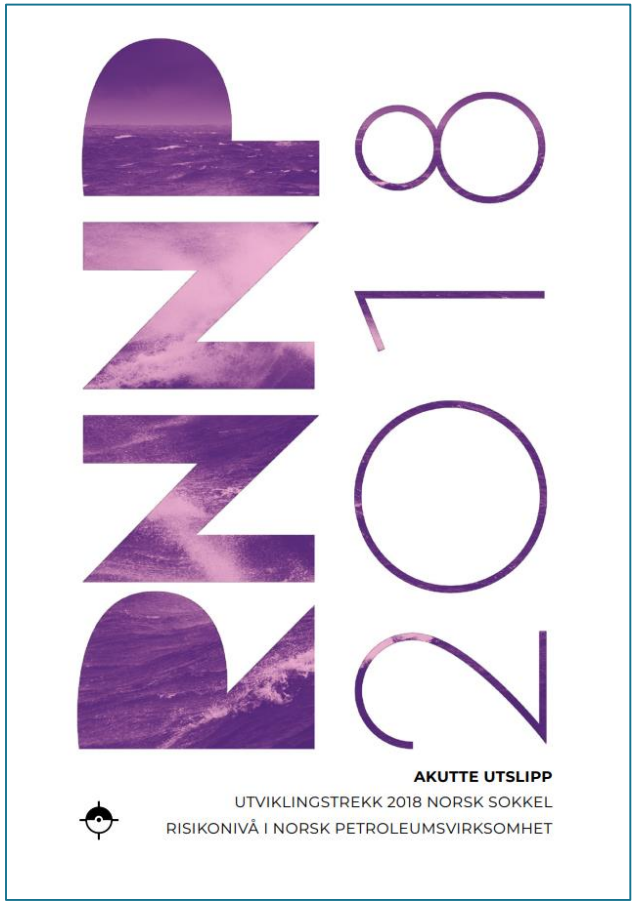
Un-bonded Flexible Risers – Recent Field Experience and Actions for Increased Robustness

Project	
Project Number	0389
Client Reference	13/600
Document	
Document Date	31.12.2013
Classification	Open
Total Number of pages including appendices	78
Document Number	0389-26583-U-0032

Revision log					
Revision no	Document revision	Date	Author(s)	Checked	Approved
02	Issued for internal review	04.11.2013	jmu/kie/jte/kpc	sal/agj/moe	hac
03	Issued for review	05.11.2013	jmu/kie/jte/kpc	sal/agj/moe	hac
04	Issued for review	09.12.2013	jmu/moe/kie/jte/kpc	ngv/agj	hac
05	Final issue	31.12.2013	jmu/moe/kie/jte/kpc	ngv/agj	hac

Trends in risk level in Norway’s petroleum activity (RNNP)





Objectives - RNNP

Measure the development in risk level

Measure effects of the HSE related work in the industry

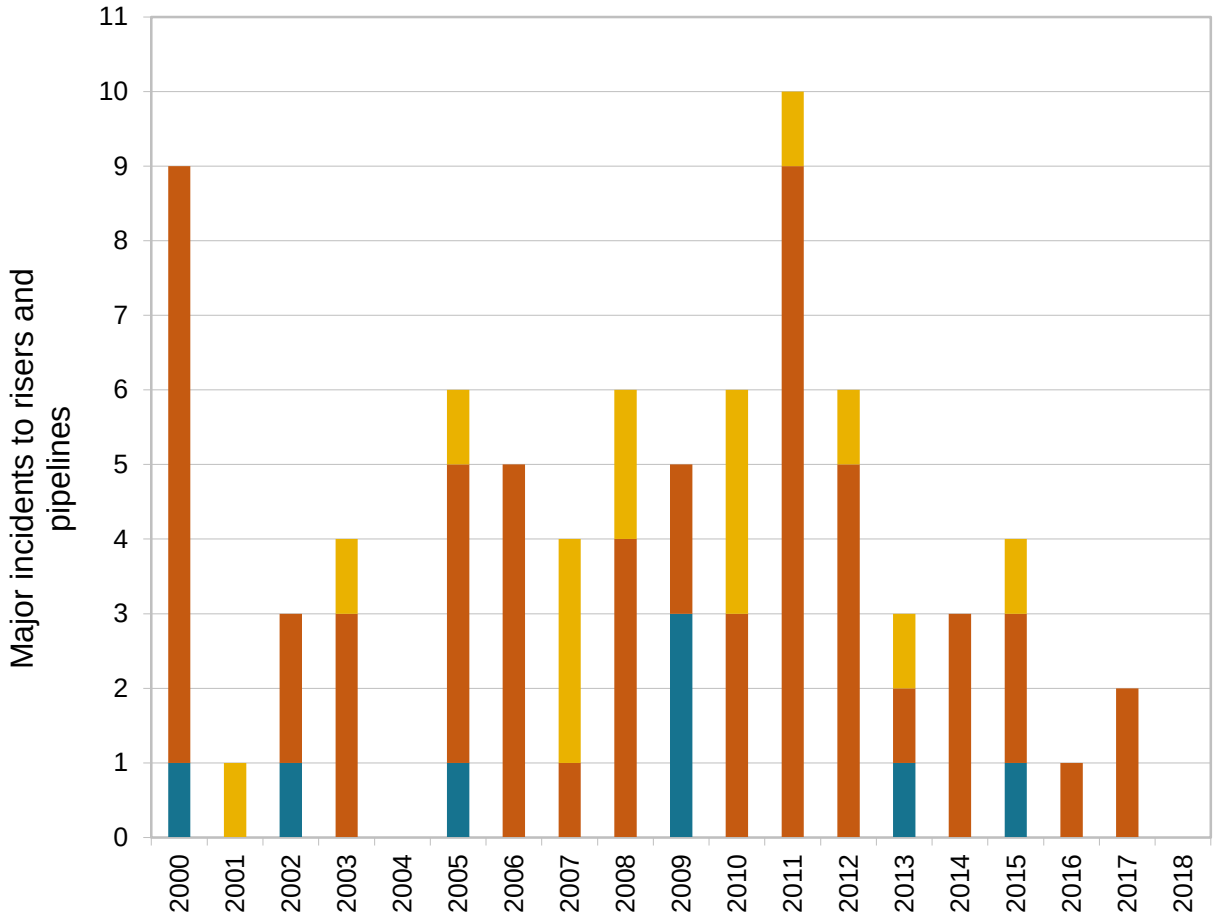
Contribute to identifying areas that are critical to HSE

Create focus on specific HSE issues

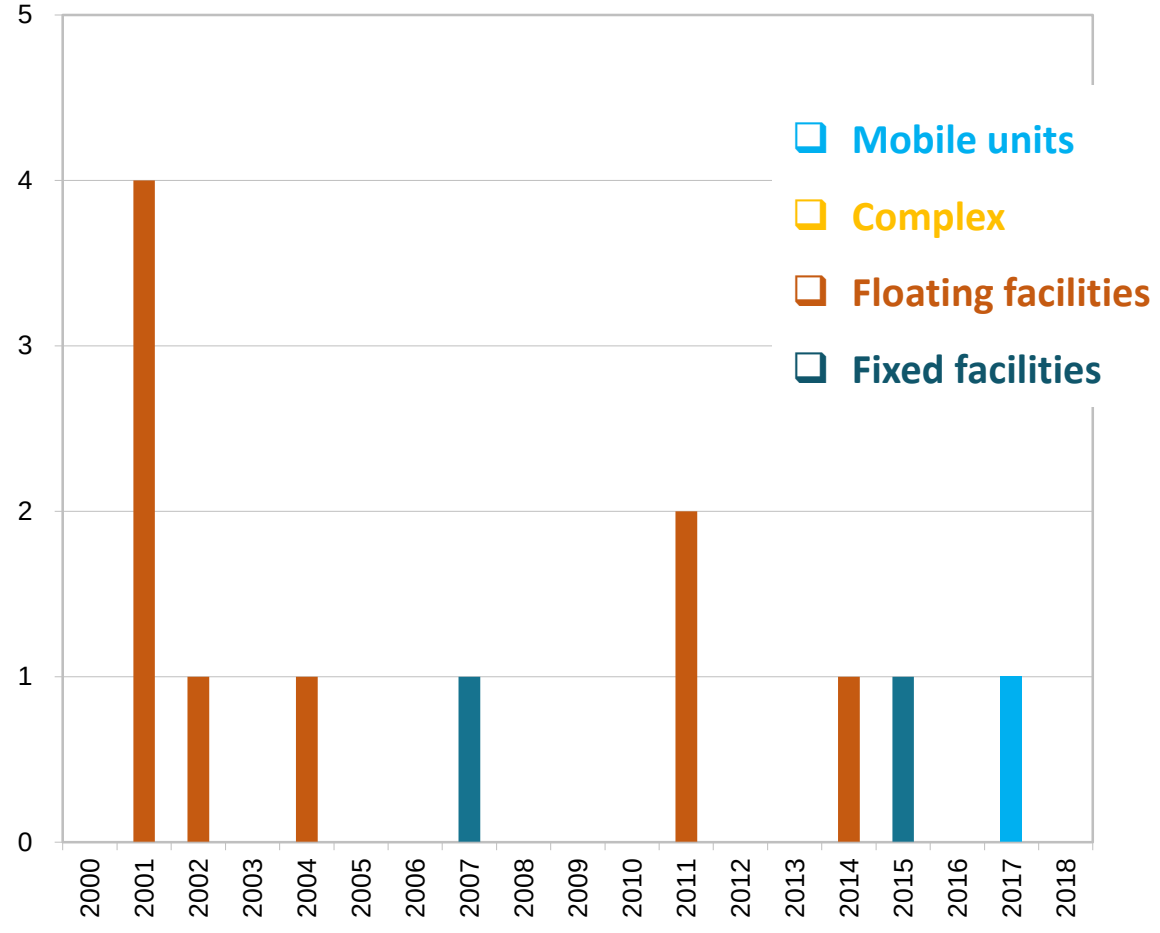
Increase insight into potential causes of accidents and undesirable conditions

Contribute to a unified understanding of the the risk level

Major incidents and leaks DFU 9 & 10

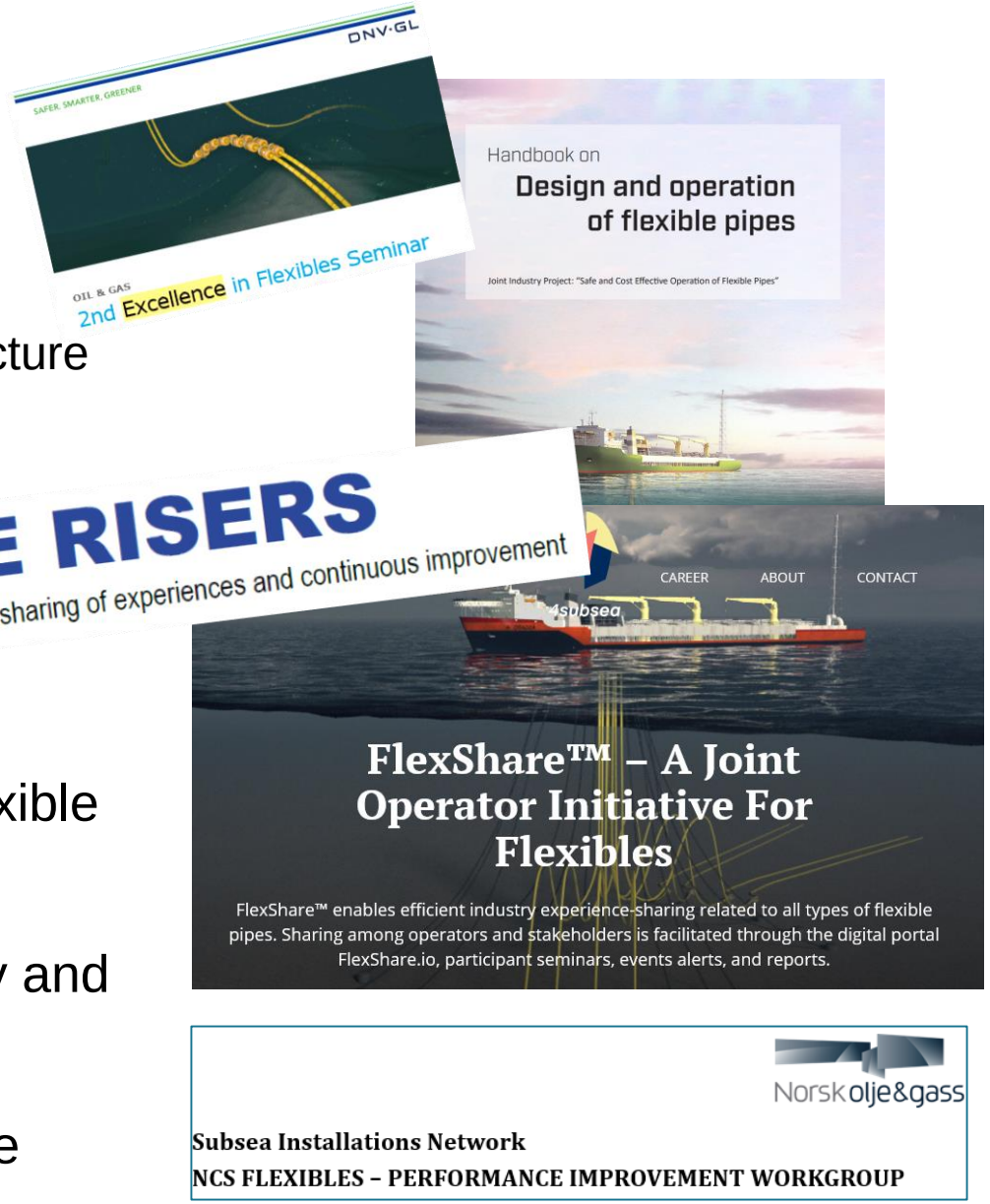


DFU 10 – Damage to riser, pipeline and subsea production facility



DFU 9 – Leak from riser, pipeline and subsea production facility

Trends in risk level for 2012



Incidents with flexible risers -> a major contributor to the risk picture

A world class expertise in Norway, though years of engineering, operation and technology development.

PSA challenged the industry to:

- Use your expertise to increasing the quality of new flexible pipelines and a better follow-up of existing ones
- Working together and share experience both internally and at a industry level.
- Ensure that the experience is used to benefit the entire industry.

Safer operation of flexible pipes

A high level for HSE shall be established, maintained and further developed to ensure prudent activities.

All matters of significance for safe operations shall be monitored and kept under control at all times – and documented.

Experience from own and others' activities must be used in the continuous improvement work to reduce risk and improved HSE

Implemented measures for risk reduction and improvement should be followed up and the effects evaluated.

There is major accident potential related to operation of flexible pipes in the petroleum activities.

Major accident means an acute incident such as a major spill, fire or explosion that immediately or subsequently entails multiple serious personal injuries and/or loss of human lives, serious harm to the environment and/or loss of major financial assets.

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Flexible pipe seminar

We expect the companies to work continuously to improve and to reduce the risk for operation of flexible pipes.

To be able to make improvements and reduce the risk we need the industry to report incidents and share information for learning.

There are regulatory requirements to document all phases of the operation and to monitor the activities. To manage the integrity we believe that it is essential to capture all relevant and necessary documentation in the planning, and design phases and through fabrication and installation to ensure safe operation. All necessary operational parameters and date needs to be logged and continuously used to monitor degradation and manage integrity for the flexible pipes. There are several tools developed for inspection of certain parts of flexibles that can be useful in specific situations, but we believe the best way of managing integrity is through continuous monitoring of relevant operational parameters like temperature, pressure, flow etc.. and use these data as well, to monitor and evaluate threats and degradation mechanisms.

Annulus monitoring (continuously) is an example of a technology that can reduce the potential in flexible riser incidents as it will give you an instant warning if there is something outside normal

Flexible pipe seminar

- Management of Integrity
  - Monitoring, surveillance, operational parameters, historical data..
- Aging
  - Use of information, data and knowledge
  - Inspections, investigations, dissections
- Continuous improvement, risk reduction
  - Management of information, operational parameters for flexibles – at all times
  - Continuous monitoring of Annulus
  - Tools and techniques for continuous monitoring and evaluation – digitalisation, machine learning etc..
  - Organisation of the work and follow up
  - Operational procedures and training

Flexible pipe seminar

- Sharing of experiences
  - NOROG – Norwegian oil and gas association,
    - Guidelines, technical, operational, life extension
    - FlexShare
  - IOGP – international oil and gas producers
    - Guidelines, technical, operational, life extension
  - DNVGL Excellence in flexibles
  - SUT – Society for underwater technology UK
    - Sureflex JIP
- Introduction of new technology – Qualification
  - Use of product outside qualification envelope!!
  - Understanding the application, knowing the use and relevant parameters – good design, operational requirements
  - Technical, organizational, operational - barriers
- Standardisation
  - Participate in update of relevant flexible standards API 17L1 and L2, API 17J, API 17TR2 etc…