

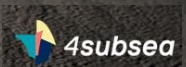


Flexible pipes – integrity management, aging, experience sharing and continuous improvement

Stavanger, 26th November 2025



Seminar on flexible pipes, integrity management and aging



08:30-09:00	Registration	12:40-13:10	Corrosion of armour wire steel in the annulus of flexible pipes- an overview of mechanisms, Arne Dugstad, IFE
09:00-09:25	Introduction and background, Summary of experiences, incidents, follow-up and trends in risk level, Trond Sundby, HAVTIL	13:10-13:40	Improving Flexible Pipe Integrity Management Through Annulus Vent Gas Monitoring, Joachim Allers, Aker BP
09:25-10:00	The History of Stress and Fatigue Analysis versus Experimental Qualification of Flexible Risers, Prof. Svein Sævik, NTNU	13:40-14:00	Coffee break
10:00-10:30	API 17J Fifth Edition: A manufacturers perspective, Claus Kristensen, NOV	14:00-14:30	Flexible pipe integrity management, the latest updates from the Sureflex JIP, Ian MacLeod, WOOD
10:30-10:50	Coffee break	14:30-15:00	Giving flexible pipes a new life through re-qualification, Øyvind Omrand, DNV
10:50-11:20	Recent challenges and experiences with flexible pipes including examples from our latest projects, Trine Risøy, 4Subsea	15:00-15:20	Collaboration in Subsea Inspection, Maintenance and Repair, Bede Ani, Flexlife
11:20-12:10	Lunch	15:20	Summing up and closing (10 min)
12:10-12:40	Experience from fibre optic monitoring of flexible risers, Einar Berentsen, Equinor		

About Havtil

Norwegian Ocean Industry Authority (Havtil)

- A directorate and supervisory authority subordinate to the Ministry of Energy (ED)
- Localized in Stavanger
- 190 employees

New name, same goal

- On 1 January 2024, the Petroleum Safety Authority Norway (PSA) changed its name to the Norwegian Ocean Industry Authority (Havtil)
- The new name reflects an expansion in the scope of our responsibility.
- We have a new name, but our goal remains the same:
 - to help safeguard life and health for everyone covered by our supervisory regime.
 - We follow up the Government's ambition for activities on the Norwegian continental shelf to be world-leading in terms of health, safety and the environment (HSE).

Areas of responsibility

- Petroleum operations offshore and at land plants
- Renewable energy production offshore (offshore wind power)
- Prospecting and extraction of seabed minerals
- CO2 transport and storage

Areas of responsibility

Petroleum activities – offshore and onshore *(January 2025)*

- 94 fields in production
- 61 fixed facilities
- 42 mobile facilities with AoCs
- 380 subsea facilities
- 2,247 active wells
- 25,000 employees offshore
- 18,300 km of pipelines
- 7 land plants

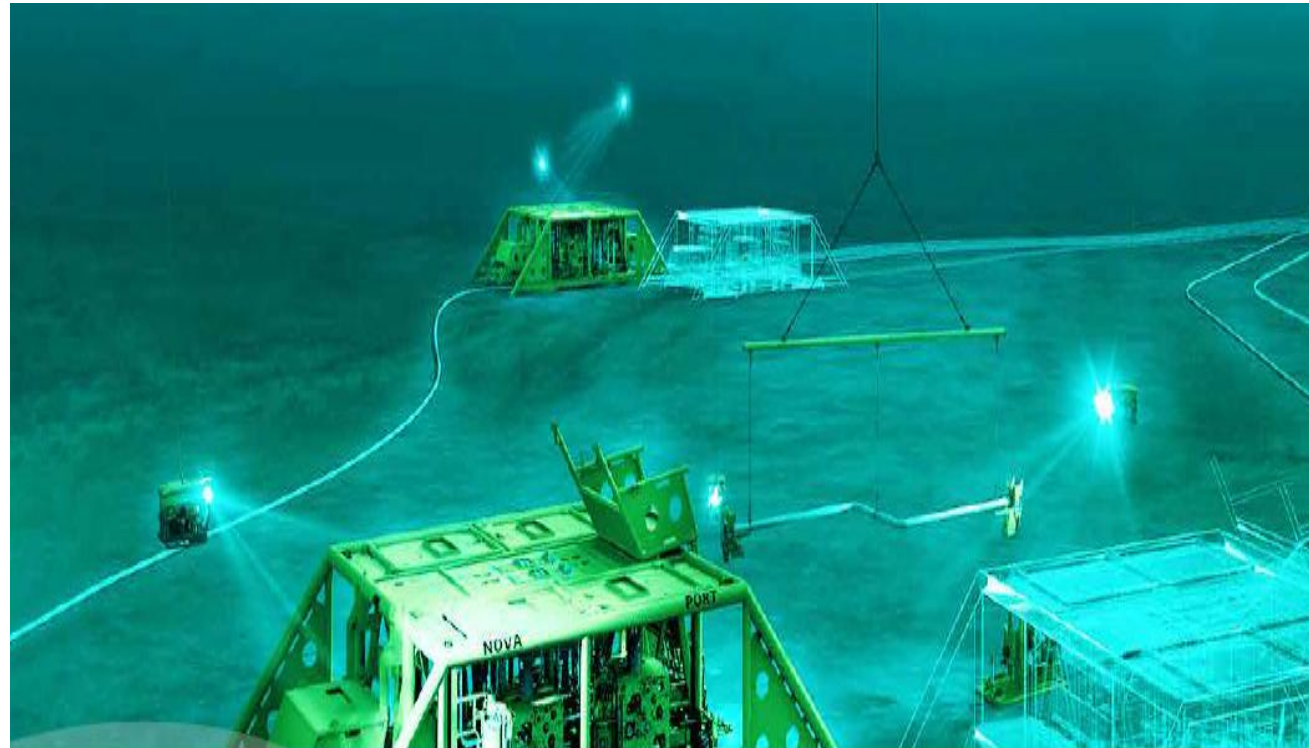
Pipelines in operation

- Around 500 risers in operation on the Norwegian Continental Shelf (NCS) – about 200 rigid steel risers and about 300 dynamic flexible risers
- Around 650 static flowlines (about 18 300km) in operation, around 500 of these (about 17 700km) rigid pipelines and around 150 of these (about 600km) static flexible flowlines.
- Several hundred spools, pipe ends / terminations and jumpers attached to these pipelines and risers
- Crossings, rock dumps, mattresses etc..



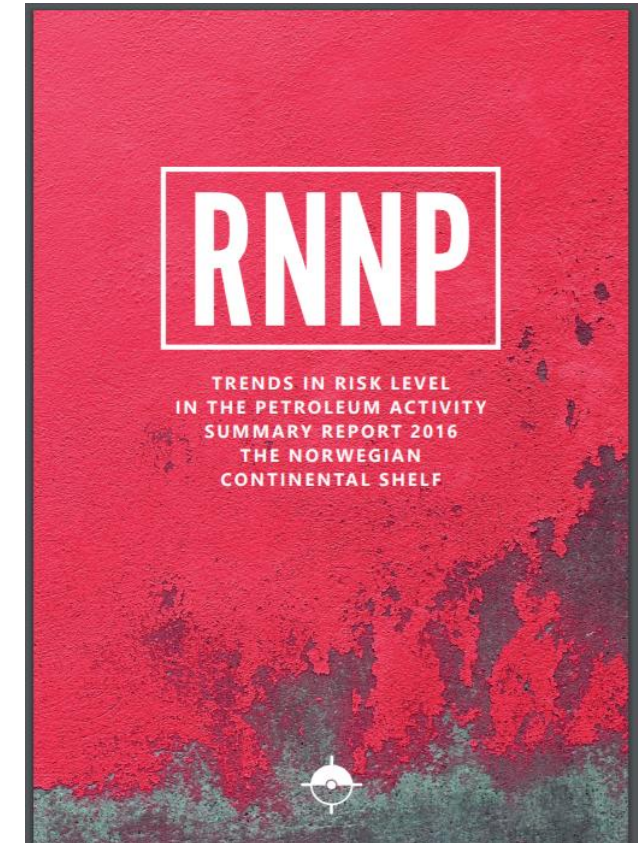
What we do

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



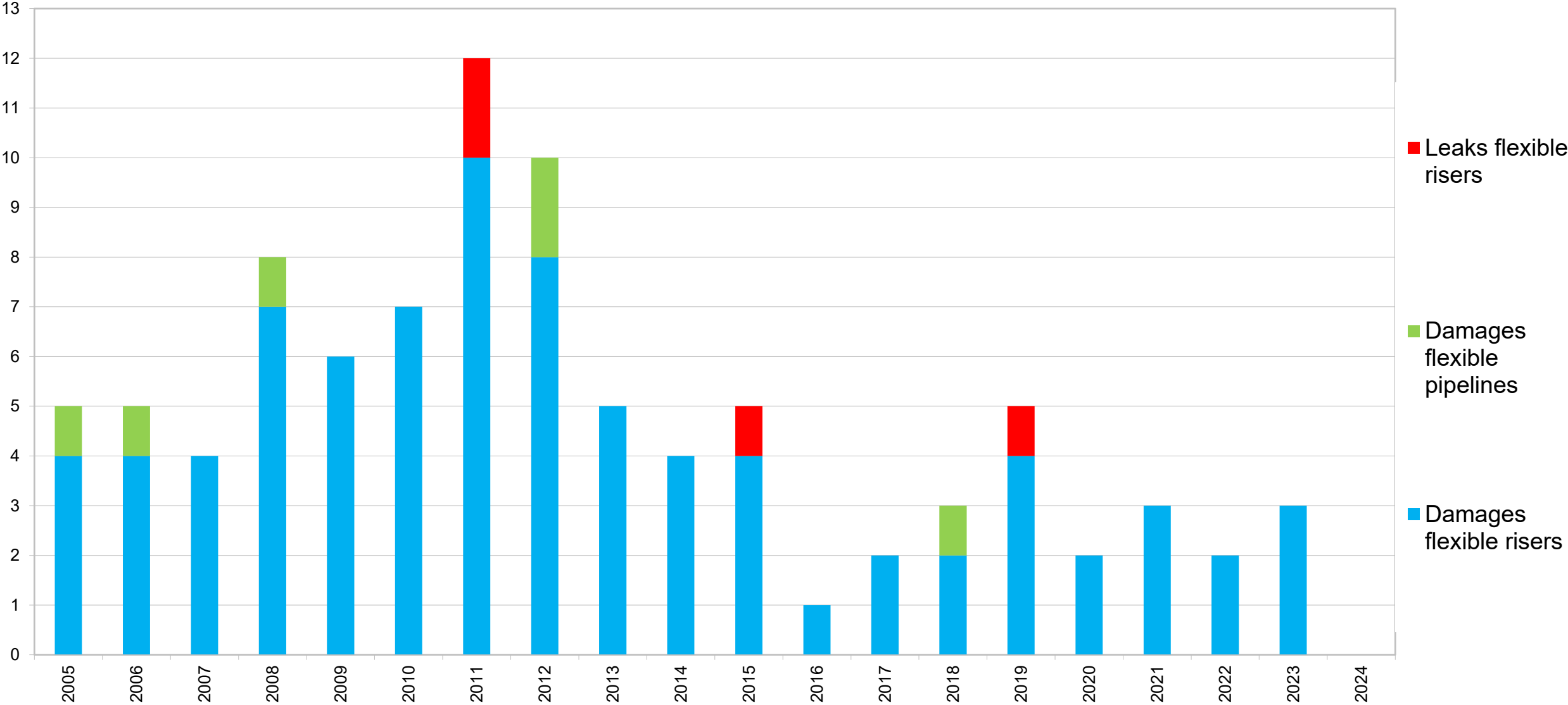
RNNP – Trends in risk level project – from 1999/2000

- Better structuring of data and, increase in quality.
- Monitoring of trends from year to year
- Project and indicators Defined hazard and accident situations (DSHAs) are based on research, Norwegian governance and regulations and cooperation with other countries
 - DSHA 1 Unignited hydrocarbon leak
 - DSHA 2 Ignited hydrocarbon leak
 - DSHA 3 Well incidents/loss of well control
 - DSHA 4 Fire/explosion in other areas
 - DSHA 5 Ship on collision course
 - DSHA 6 Drifting object
 - DSHA 7 Collision with field-related vessel/facility/shuttle tanker
 - DSHA 8 Damage to a facility's structure, stability/anchoring/positioning failure
 - **DSHA 9 Leak from riser, pipeline and subsea production facility**
 - **DSHA 10 Damage to riser, pipeline and subsea production facility**
 - DSHA 11 Evacuation
 - DSHA 12 Helicopter incident
 - DSHA 13 Man overboard
 - DSHA 14 Occupational accidents
 - DSHA 15 Work-related illness
 - DSHA 16 Full loss of power
 - DSHA 18 Diving accident
 - DSHA 19 H2S emission
 - DSHA 20 Crane and lifting operations
 - DSHA 21 Dropped objects



- Land facilities included in 2005 and Acute Emissions (RNNP-AU) included in 2010
- In addition to the annual RNNP-report we also provide a method report for the RNNP-project.

Major damages and leaks to flexible pipes and risers (500m zone)



LOOKING BACK – RNNP for 2012

The industry needs to address the following improvement areas:

- the industry must do a better job at **sharing information** between companies in order to ensure **continuous improvement** throughout the sector
- clear and unambiguous **responsibilities** for safe operation and integrity management
- ensure good **training and expertise** throughout the organisation responsible for following up integrity
- **integrity management** of flexible risers with **continuous monitoring** and systems for documenting operations history, which are actively used in follow-up
- quick and precise **incident reporting** associated with pipelines, risers and subsea facilities
- updating **standards** with the most recent experience
- the industry must actively commit to **research and development** in order to increase knowledge about flexible risers



Referenced standards in our regulations – flexibles

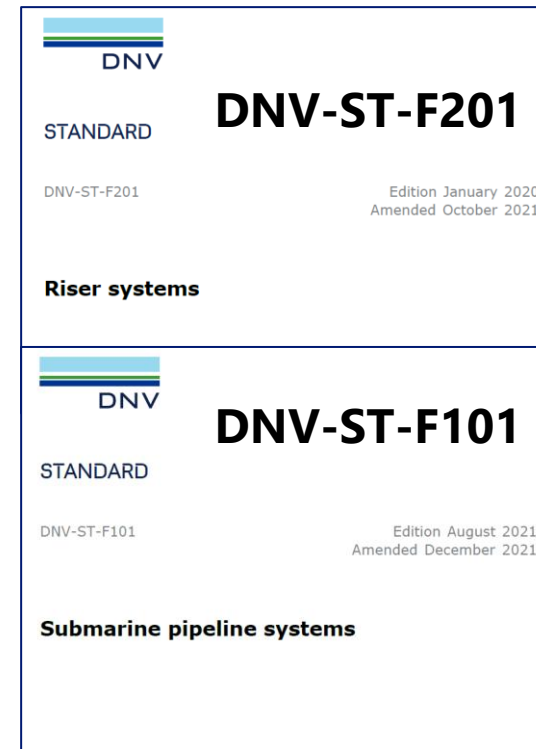
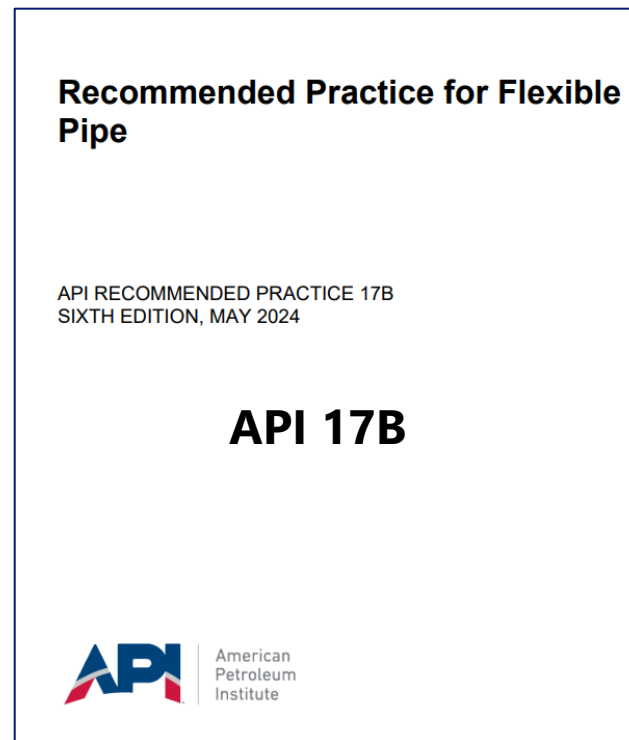
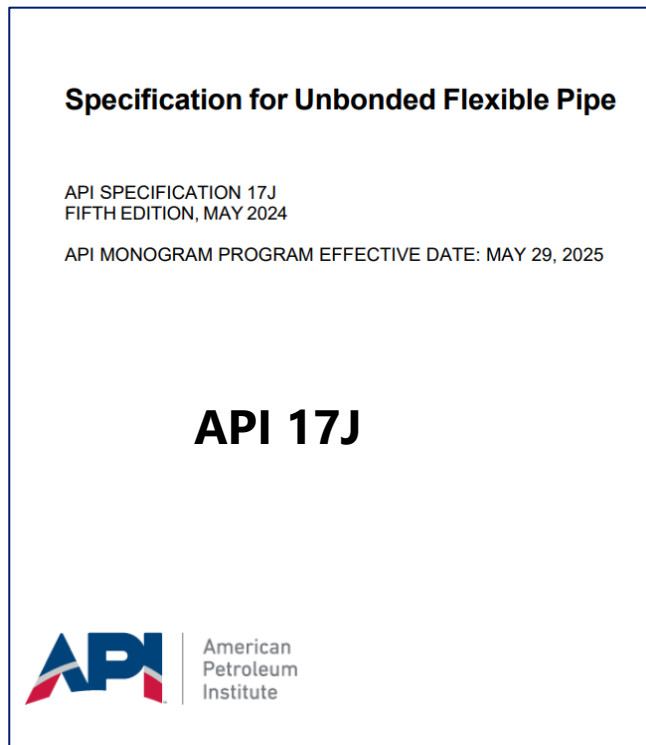
Framework regulations § 24 Use of recognised standards

When the responsible party makes use of a standard recommended in the guidelines...,...the responsible party can normally assume that the regulatory requirements have been met.

When other solutions than those recommended in the guidelines..., are used, the responsible party shall be able to document that the chosen solution fulfils the regulatory requirements.

From guideline:

Use of recognised standards is voluntary to the extent that other technical solutions, methods or procedures can be chosen if the responsible party can document that regulatory requirements will be fulfilled.



Various relevant industry reports related to incidents, learning and

SEALEX

PSA - Norway Flexible

Failure modes, inspection and monitoring

02	Issued for information	
01	Issued for client review	
00	Issued for internal review	
Rev	Reason for issue	

Doc.no: 56

4subsea

PSA Norway State of the art

PROJECT	
Project Number:	PS
Project Name:	
Client ref.:	
Customer:	
DOCUMENT	
Document Title:	State
Document Number:	
Document Date [dd.mm.yyyy]:	
Document Revision:	
Reason for issue:	
Confidentiality:	
RESPONSIBLE	
Author	
Checked	
Approver	

4subsea

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	
Revision log		
Revision no.	Document revision	Date
02	Issued for internal review	04.
03	Issued for review	05.
04	Issued for review	09.
05	Final issue	31.

1255 - PSA Norway

State of the art Bonded Flexible Pipes

Document number:	26583U-1161480
Revision number:	2.0
Approval date:	17.12.2018

DNV

INTEGRITY MANAGEMENT AND CONDITION MONITORING OF UNDERWATER SYSTEMS IN OPERATION

Subsea Integrity Management – Maintaining and improving the risk level

Petroleumstilsynet

Report No.:	2021-1109, Rev. 0
Document No.:	1247719
Date:	2021-12-05

UKAS

4388

Sureflex

Flexible Pipe Integrity Management Guidance & Good Practice

Prepared for:	Sureflex JIP Members
Doc Ref:	807511-00-IM-GLN-001
Rev:	02
Date:	August 2023

Flexible pipes 2007

https://www.ptil.no/contentassets/a4c8365164094826a24499ef9f22742b/p5996rpt01rev02cseaflex_janmuren.pdf

Bonded flexible pipes 2008

[Technology status for bonded flexible pipes report-on-bonded-flexible-pipes2009.pdf](https://www.ptil.no/contentassets/a4c8365164094826a24499ef9f22742b/p5996rpt01rev02cseaflex_janmuren.pdf)

Unbonded flexible risers 2013

[Report on flexible risers](https://www.ptil.no/contentassets/a4c8365164094826a24499ef9f22742b/p5996rpt01rev02cseaflex_janmuren.pdf)

[Un-bonded Flexible Risers – Recent Field Experience and Actions for Increased Robustness](https://www.ptil.no/contentassets/a4c8365164094826a24499ef9f22742b/p5996rpt01rev02cseaflex_janmuren.pdf)

Bonded flexibles 2018

[Incidents and failure modes linked to bonded flexible pipes and hoses State of the art Bonded Flexible Pipes 2018](https://www.ptil.no/contentassets/a4c8365164094826a24499ef9f22742b/p5996rpt01rev02cseaflex_janmuren.pdf)

Subsea integrity 2020/2021

[Subsea Integrity Management – Maintaining and improving the risk level](https://www.ptil.no/contentassets/a4c8365164094826a24499ef9f22742b/p5996rpt01rev02cseaflex_janmuren.pdf)

[dnv-report-no.-2021.pdf](https://www.ptil.no/contentassets/a4c8365164094826a24499ef9f22742b/p5996rpt01rev02cseaflex_janmuren.pdf)

[Management of integrity from wellhead to facility](https://www.ptil.no/contentassets/a4c8365164094826a24499ef9f22742b/p5996rpt01rev02cseaflex_janmuren.pdf)

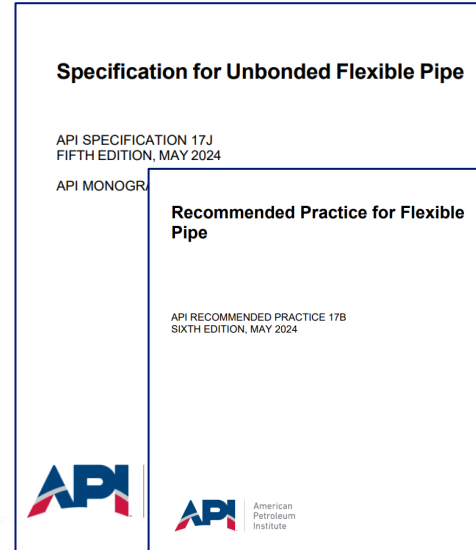
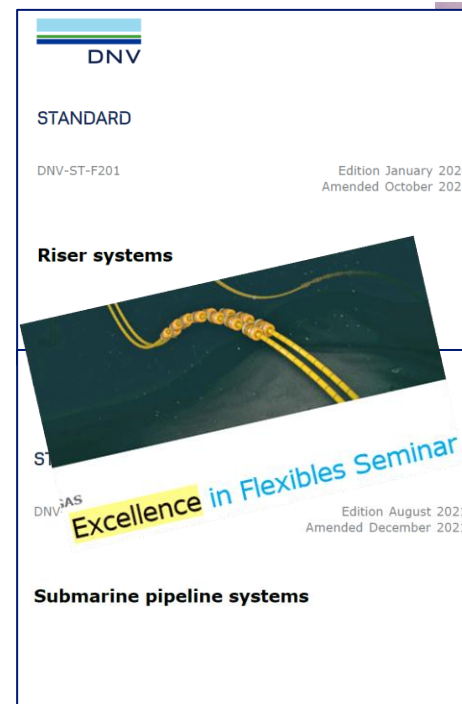
[Guideline to Subsea Integrity Management - Wellhead to Topside ESDV](https://www.ptil.no/contentassets/a4c8365164094826a24499ef9f22742b/p5996rpt01rev02cseaflex_janmuren.pdf)

[Integrity management and condition monitoring of pipes and subsea installations](https://www.ptil.no/contentassets/a4c8365164094826a24499ef9f22742b/p5996rpt01rev02cseaflex_janmuren.pdf)

[integritetsstyring-og-tilstandskontroll-av-royr-og-subsea.pdf](https://www.ptil.no/contentassets/a4c8365164094826a24499ef9f22742b/p5996rpt01rev02cseaflex_janmuren.pdf)

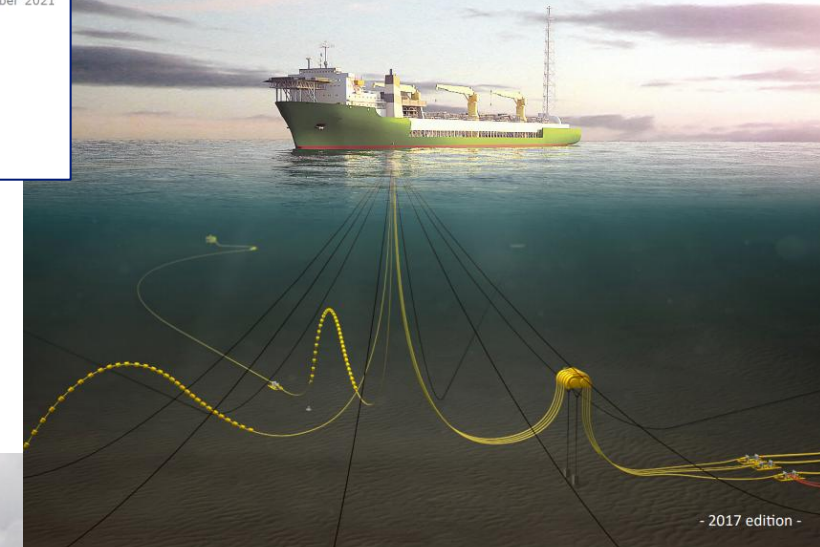
Arenas for Cooperation

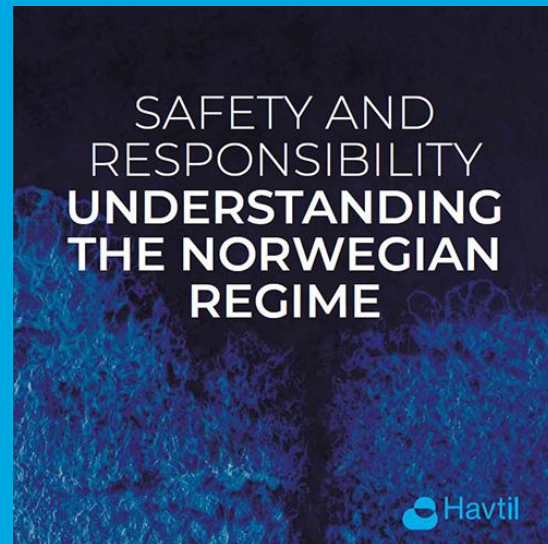
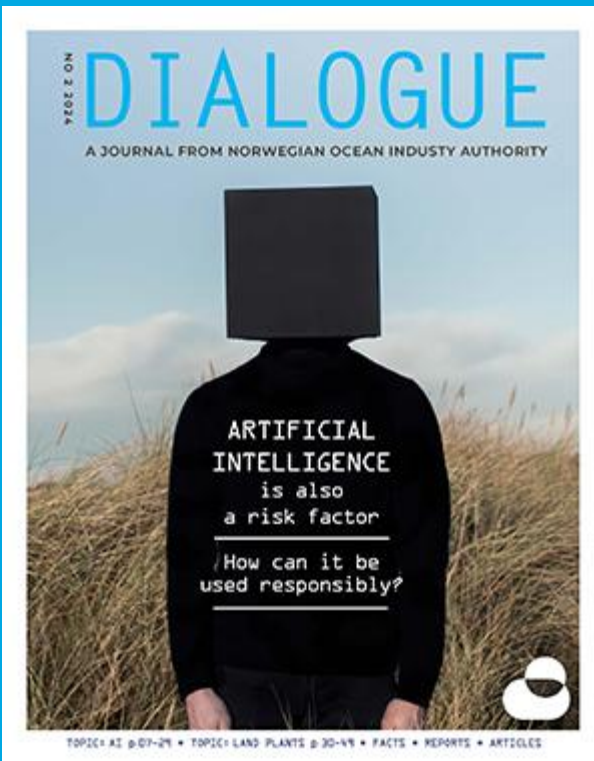
- Groups for sharing of experiences
- Standardisation groups
- JIPs
- Conferences
- Academia
- ...



Handbook on Design and operation of flexible pipes

Joint Industry Project: "Safe and Cost Effective Operation of Flexible Pipes"





Relevant publications

Read online: Magazines and publications
Order paper editions: dialog@havtil.no

Useful films

- Main theme 2025
- Trends in risk level (RNNP) in one minute
- Barriers in three minutes
- Once upon a time...
(About developments in safety)
- New energy adventure at sea
- How can risk be managed?
- What is the ambition for safety?

