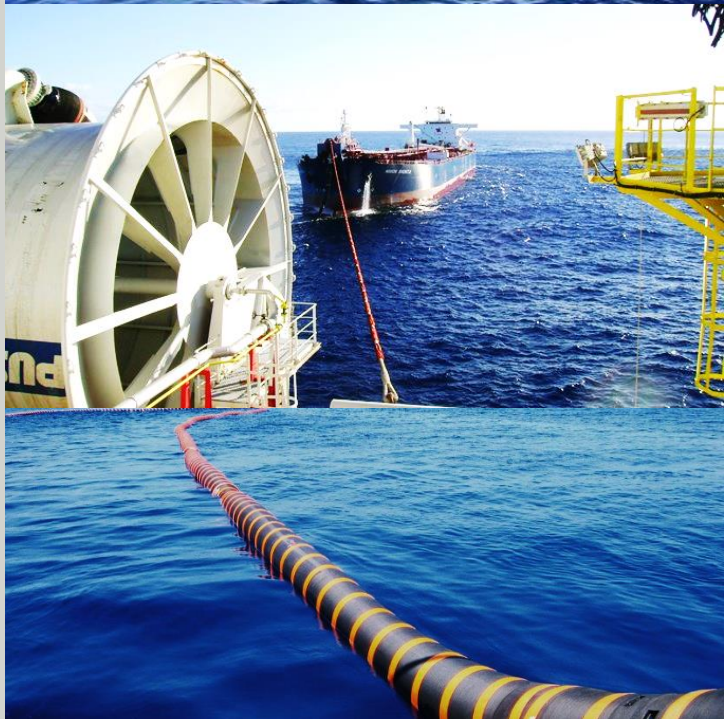
Integrity Management of Bonded Flexible Pipes

Svein Are Løtveit | Senior Advisor | 4Subsea

PSA Study: State of the art for bonded flexible pipes 2018 - free download

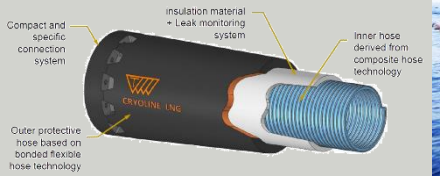
Agenda

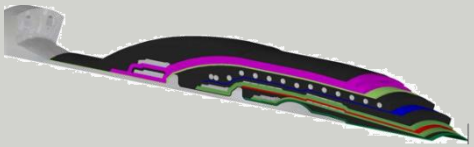
- Bonded flexible pipe designs
- Guidelines and specifications
- Issues with bonded pipes
- Integrity management & life time extension
- FlexShare™ – Sharing experiences between operators

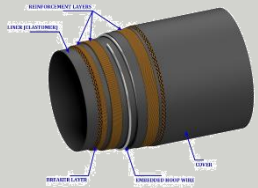


Bonded Flexible Pipe Designs

- Bonded flexible risers
- Crude Loading hoses
- LPG offloading hoses
- LNG offloading hoses
- Seawater Intake hoses
- Hoses for exploration
- Industrial Hoses







Guidelines & Specifications

- Design and operation of bonded hoses are specified by a range of different guidelines and specifications depending on type and use
- There is a need to harmonize:

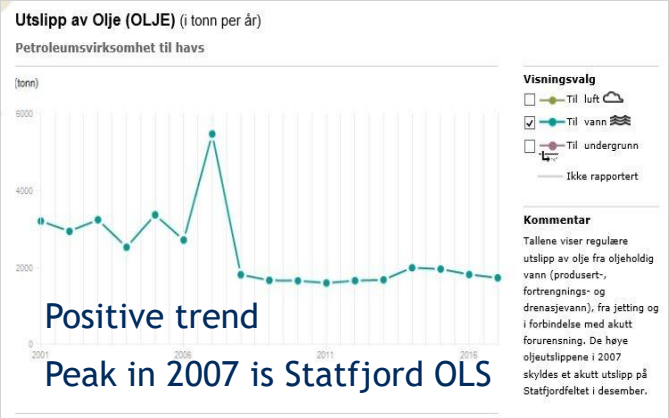
"No communication API 17K, GMPHOM, EN 1474-2, EN 1762 to harmonize requirements. API SC17 dropped ISO 13628- in 2011 due to trade sanctions and IP. EN 1474-2 is a design-by-testing standard (misses long term degradation mechansims), API 17K is a design-by-understanding standard"

Krassimir Doynov
Chairman of API commitee

- API 17K
- GMPHOM 2009
- EN1762, (API17K)
- EN1474-2(API 17K)
- API 7K
- API 16C
- Type approval, purchasing requirements

Issues with bonded flexibles

- Failure statistics from PSA Norway
  - 3% of drilling issues related to leak from hose
  - 1 personnel injurie due to whipping hose (Large energy release when stretched hose fail, handle with care)
  - Several wear and mishandling issues
  - Many industrial hose failures due to misuse and inadequate maintenance
  - Incomplete reporting as hoses are replaced regularly
- Oil spill
  - Bonga, December 2011, oil spill ~40,000 barrels of crude
  - Statfjord 2007
  - Many small ref e.g. ITOPF (oil-spill 7-700t 1970-2017)



	Operations			
	Loading/ Discharging	Bunkering	Other Operations	Unknown
Allision/Collision	5	0	60	299
Grounding	0	0	27	244
Hull Failure	37	4	15	45
Equipment Failure	147	6	17	39
Fire/Explosion	5	0	14	26
Other	98	13	36	28
Unknown	99	9	14	81
Total	395	32	183	762
Percentage (%)	29	2	13	56

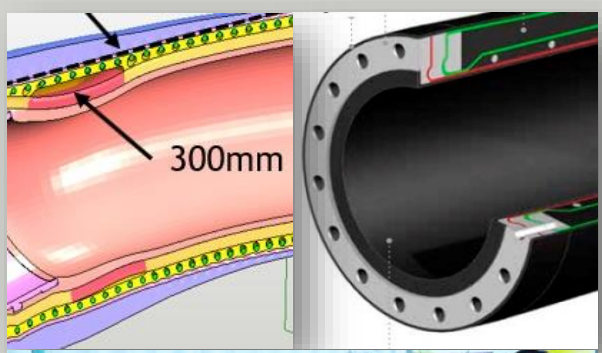
Qualification

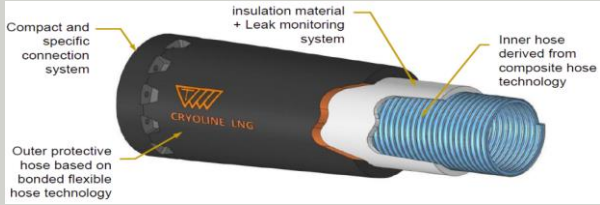
New technology – New Applications

- New in-service failure modes

  (Crude offloading hoses in demanding applications where extensive qualification have been executed)

- Enabling technology
  - FLNG(Floating LNG production unit) seawater intake hoses
  - LNG offloading hoses.
  - No known issues, however, experience is limited.
- Both oil spill and costly production down time has occurred





Do not forget Corrosion

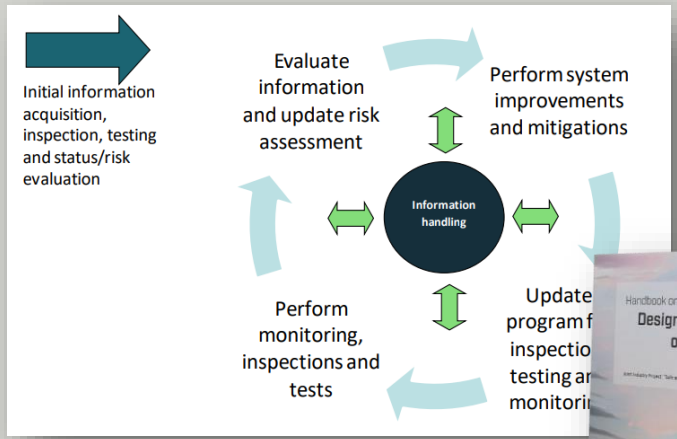
New and old threats

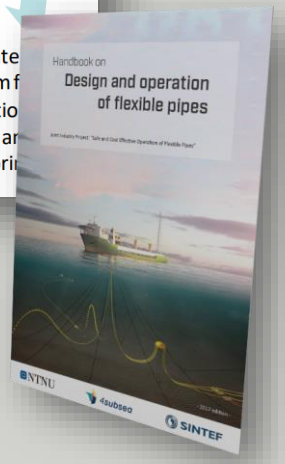
- Steel cord corrosion
- Nipple corrosion
- Internal corrosion

Integrity Management

Bonded pipes

- Information handling
- Risk Based Inspection Planning
- Inspection
- Testing
- Monitoring



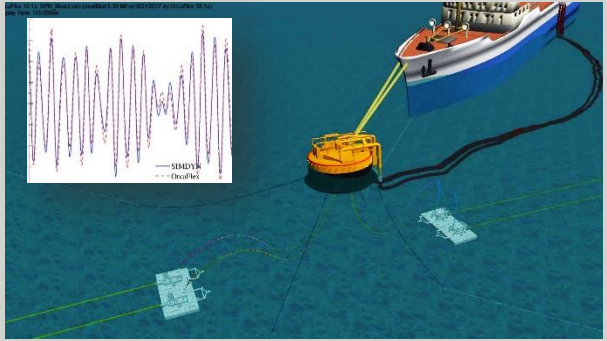


It is imperative that the operator has complete control of the individual hose segment design and operational history to ensure fit for purpose throughout the entire lifetime.

Life extension & Recertification

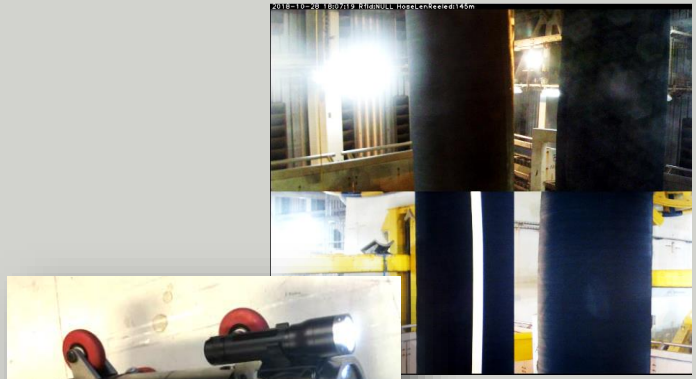
API17K hoses vs industrial hoses

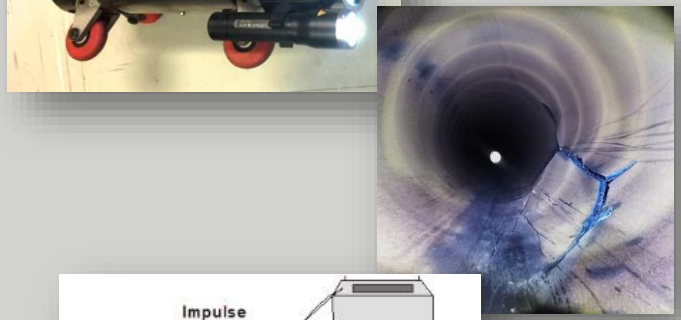
- API 17K hoses
  - Service life = Field life
  - Engineering based assessment
    - *Design methodology and requirements*
    - *Design criteria (layer specific)*
    - *Loads and load effects for pipe and end fitting*
    - *Service life analysis*
    - *Material selection and qualification*
    - *Testing requirements*
  - Site specific replacement intervals and Life Time Extension possible
- OCIMF
  - GMPHOM 2009 & Maintenance / Operation Guide 2015
    (Standardised inspection test and replacement program)
- Other
  - Standard service life for some hoses
  - Purchaser or manufacturer recommendations

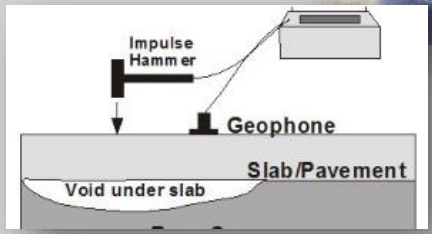


Inspection tools

- External visual
- Internal visual
- Defect monitoring (X-ray, Ultrasonic, Sonic) e.g. Intelligent pig
- Pressure testing/ recertification







Both purchasers and manufacturer have improved field tools on their wish list

Summary

- Bonded flexible pipe is an enabling technology used in many different applications
- There is a need to harmonize specifications and guidelines
- Reliability of the type approved flexibles(hoses) is good
  (API monogrammed hoses, GMPHOM 2009 hoses and type approved hoses)
- Reported hose failures dominated by
  - low quality hoses,
  - hoses operated outside design specification
  - Insufficient qualification of new technology
  - inadequate maintenance.
- Management of lifecycle information and a well-planed integrity management program is key for safe operation and extended life of bonded pipes
- The exchange of operational experience and product limitations could be improved

FlexShare™

A Joint Operator Initiative For Flexibles

Christoffer Nilsen-Aas | VP Digital Services | 4Subsea

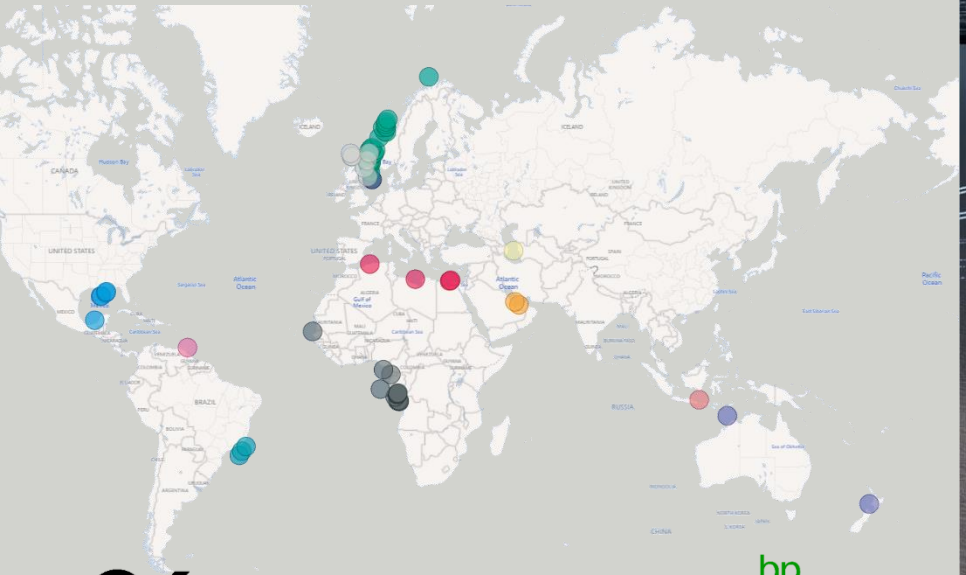
The FlexShare™ vision:

“To be a trustworthy arena for sharing flexible pipe experiences, so that all stakeholders contribute to risk and cost reduction for design and operation of flexible pipes.”

FlexShare™

- FlexShare™ has evolved from oil & gas operators, with the overall objective to facilitate efficient industry experience-sharing related to all types of flexible pipes.
- Based on a modern digital cloud solution
- Sharing between operators and other relevant stakeholders is facilitated through the digital portal FlexShare.io and participant seminars.
- FlexShare™ is very flexible and scalable, so that operators can pull and present virtually any data in the format they see fit, have tools for benchmarking and comparison, and facilitate smart support to learn more by anonymously contacting other operators.

FlexShare™ in Numbers



Members
8

Number of Pipes
1508

Number of Events
142

The Sharing Arena

- Immediate alerts on high risk failure modes
- Bi-monthly newsletters with updates on new events & learnings, developments and ideas
- Bi-annual issues of the FlexShare™ bulletin
- Seminars for round-table-sharing, networking and presentations from industry stakeholders
- Knowledge center for access to all shared material from seminars

- 24/7 access to FlexShare.io – digital platform

Home
Events
Pipes
Dashboards
My Events and Pipes
All Events and Pipes

All Events and Pipes

Area	Flowline	Riser	Total
		20	20
Asia		3	3
Brasil	55	20	75
Caspian Sea	17		17
Gulf of Mexico	11	11	22
NCS	220	438	658
North Africa	21	14	35
Oceania		11	11
Other	5	17	22
Persian Gulf	2		2
UK	314	58	372
West Africa	83	188	271
Total	**728**	**780**	**1508**

1508 Number of pipes
12.0 Average age (year)
1,249,862 Total length (m)
537 Average water depth

64 Number of shared events

Flowline
Riser

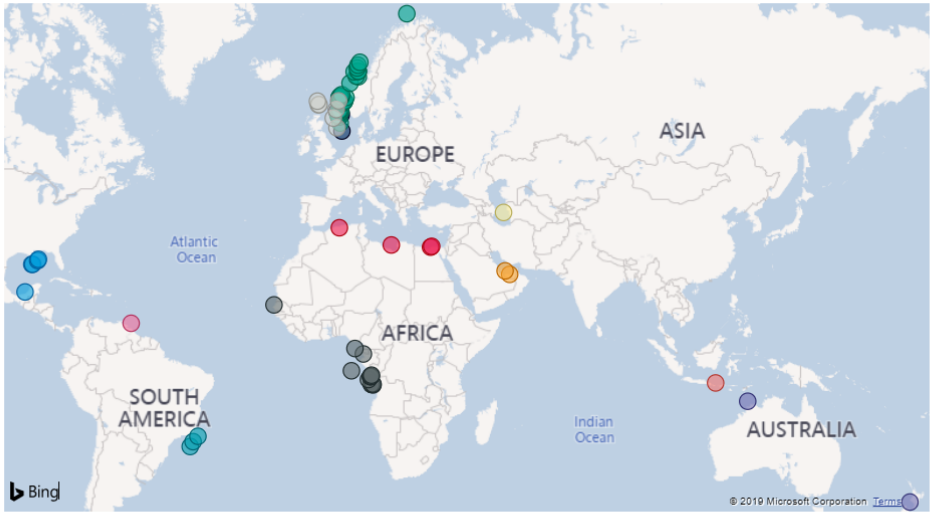
Pipes with Shared Events

Abandoned
Operational
Other
Recovered
Spare

Average Field Water Depth
30.00
2,700.00

Number of pipes by average age (5 year interval)
Type Flowline Riser
200
0
0 10 20 30 40

Area (Blank) Asia Brasil Caspian Sea Gulf of Mexico NCS North Africa Oceania Other Persian Gulf UK West Africa



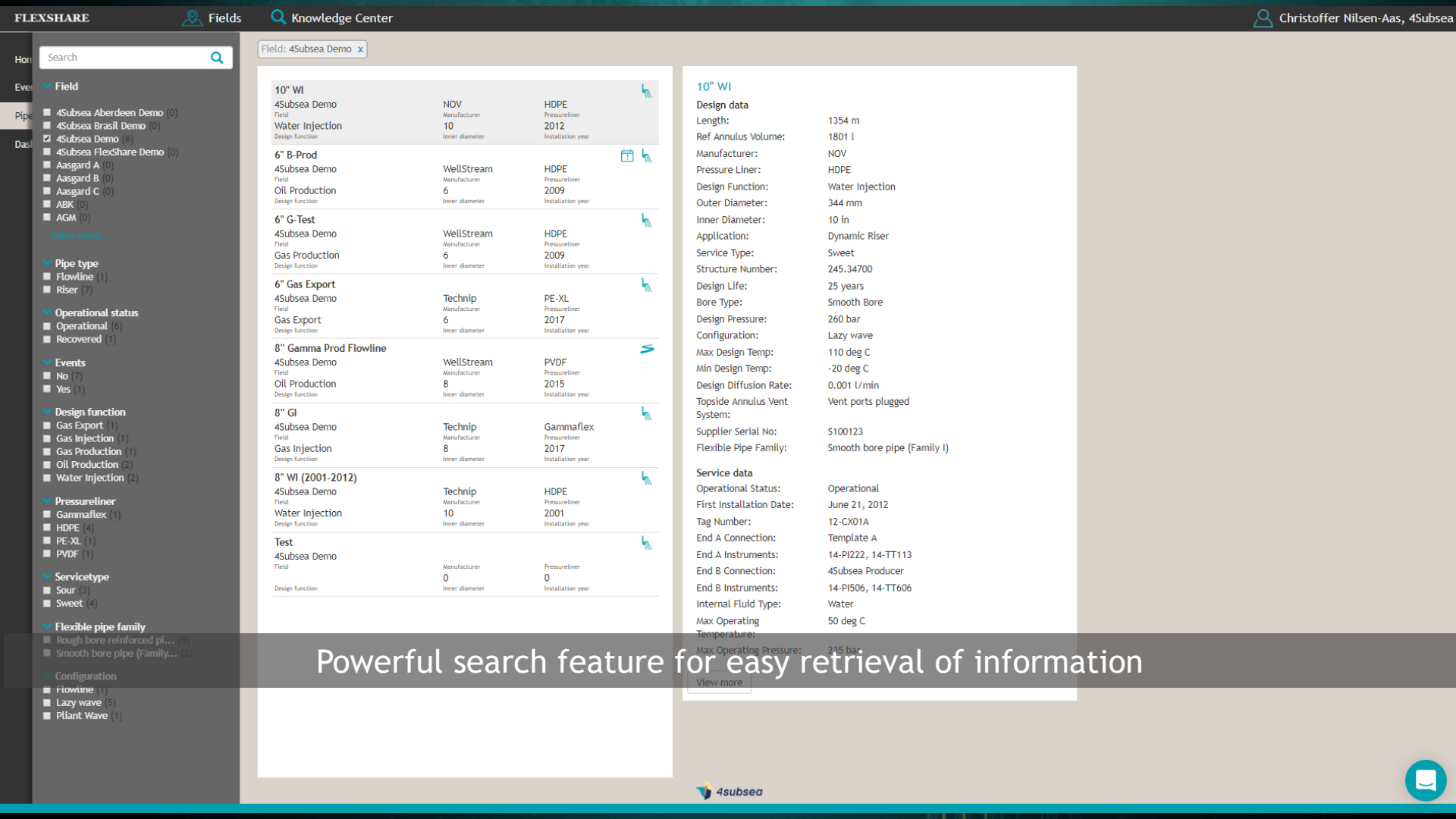
Event origin
Other 5%
(Blank) 3%
Operation... 38%
Design 44%
Installatio... 8%

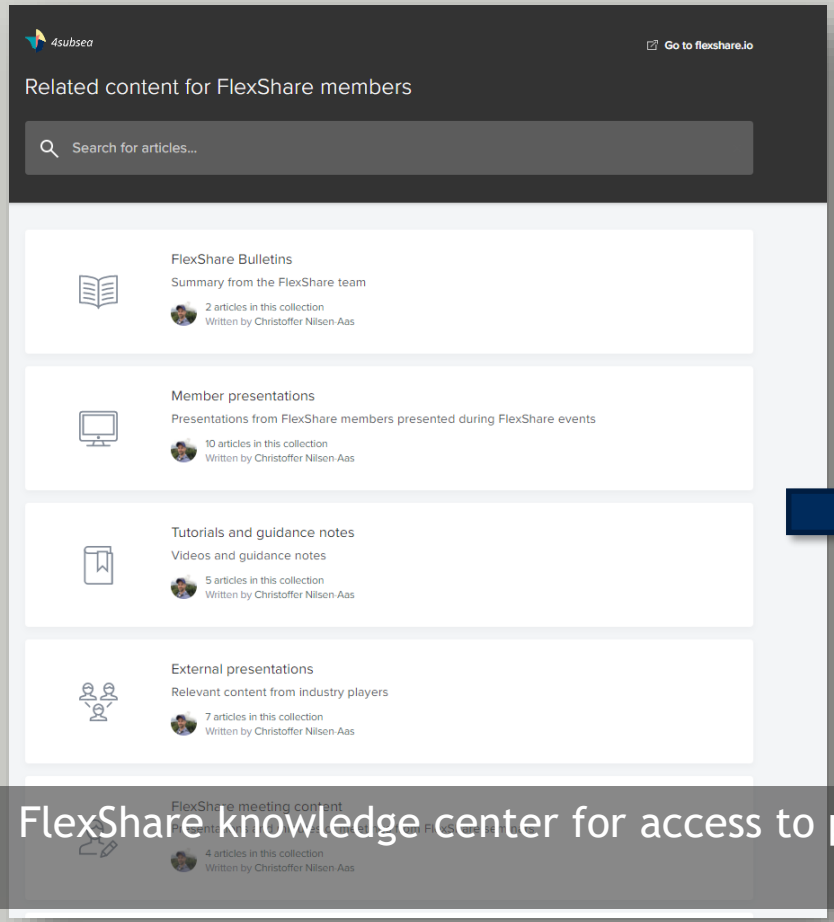
Distribution of events per main component
Tether/Clamp 9%
Pipe 75%

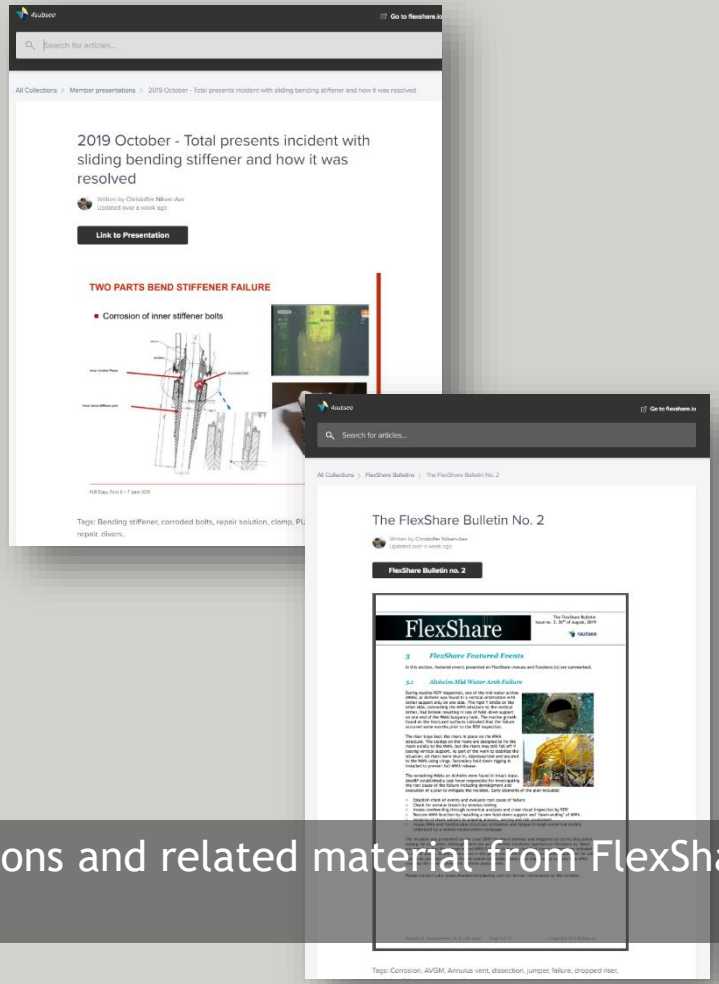
Distribution of events per pipe layer
Pressure s... 13%
Not relevant 34%
Outer she... 17%
Carcass 27%

Explore FlexShare data by clicking on the tabs below

Interactive reports enables users to work with the data and create their own insight


FLEXSHARE
Fields
Knowledge Center
Christoffer Nilsen-Aas, 4Subsea
Search
Field
4Subsea Aberdeen Demo (0)
4Subsea Brasil Demo (0)
4Subsea Demo (8)
4Subsea FlexShare Demo (0)
Aasgard A (0)
Aasgard B (0)
Aasgard C (0)
ABK (0)
AGM (0)
Show more...
Pipe type
Flowline (1)
Riser (7)
Operational status
Operational (6)
Recovered (1)
Events
No (7)
Yes (1)
Design function
Gas Export (1)
Gas Injection (1)
Gas Production (1)
Oil Production (2)
Water Injection (2)
Pressureliner
Gammaflex (1)
HDPE (4)
PE-XL (1)
PVDF (1)
Servicetype
Sour (3)
Sweet (4)
Flexible pipe family
Rough bore reinforced pi... (5)
Smooth bore pipe (Family... (2)
Configuration
Flowline (1)
Lazy wave (5)
Pliant Wave (1)
Field: 4Subsea Demo
10" WI
4Subsea Demo
NOV
HDPE
Water Injection
10
2012
6" B-Prod
4Subsea Demo
WellStream
HDPE
Oil Production
6
2009
6" G-Test
4Subsea Demo
WellStream
HDPE
Gas Production
6
2009
6" Gas Export
4Subsea Demo
Technip
PE-XL
Gas Export
6
2017
8" Gamma Prod Flowline
4Subsea Demo
WellStream
PVDF
Oil Production
8
2015
8" GI
4Subsea Demo
Technip
Gammaflex
Gas Injection
8
2017
8" WI (2001-2012)
4Subsea Demo
Technip
HDPE
Water Injection
10
2001
Test
4Subsea Demo
0
0
10" WI
Design data
Length: 1354 m
Ref Annulus Volume: 1801 l
Manufacturer: NOV
Pressure Liner: HDPE
Design Function: Water Injection
Outer Diameter: 344 mm
Inner Diameter: 10 in
Application: Dynamic Riser
Service Type: Sweet
Structure Number: 245.34700
Design Life: 25 years
Bore Type: Smooth Bore
Design Pressure: 260 bar
Configuration: Lazy wave
Max Design Temp: 110 deg C
Min Design Temp: -20 deg C
Design Diffusion Rate: 0.001 l/min
Topside Annulus Vent System: Vent ports plugged
Supplier Serial No: S100123
Flexible Pipe Family: Smooth bore pipe (Family I)
Service data
Operational Status: Operational
First Installation Date: June 21, 2012
Tag Number: 12-CX01A
End A Connection: Template A
End A Instruments: 14-PI222, 14-TT113
End B Connection: 4Subsea Producer
End B Instruments: 14-PI506, 14-TT606
Internal Fluid Type: Water
Max Operating Temperature: 50 deg C
Max Operating Pressure: 225 bar
View more
Powerful search feature for easy retrieval of information
4subsea





FlexShare knowledge center for access to presentations and related material from FlexShare venues

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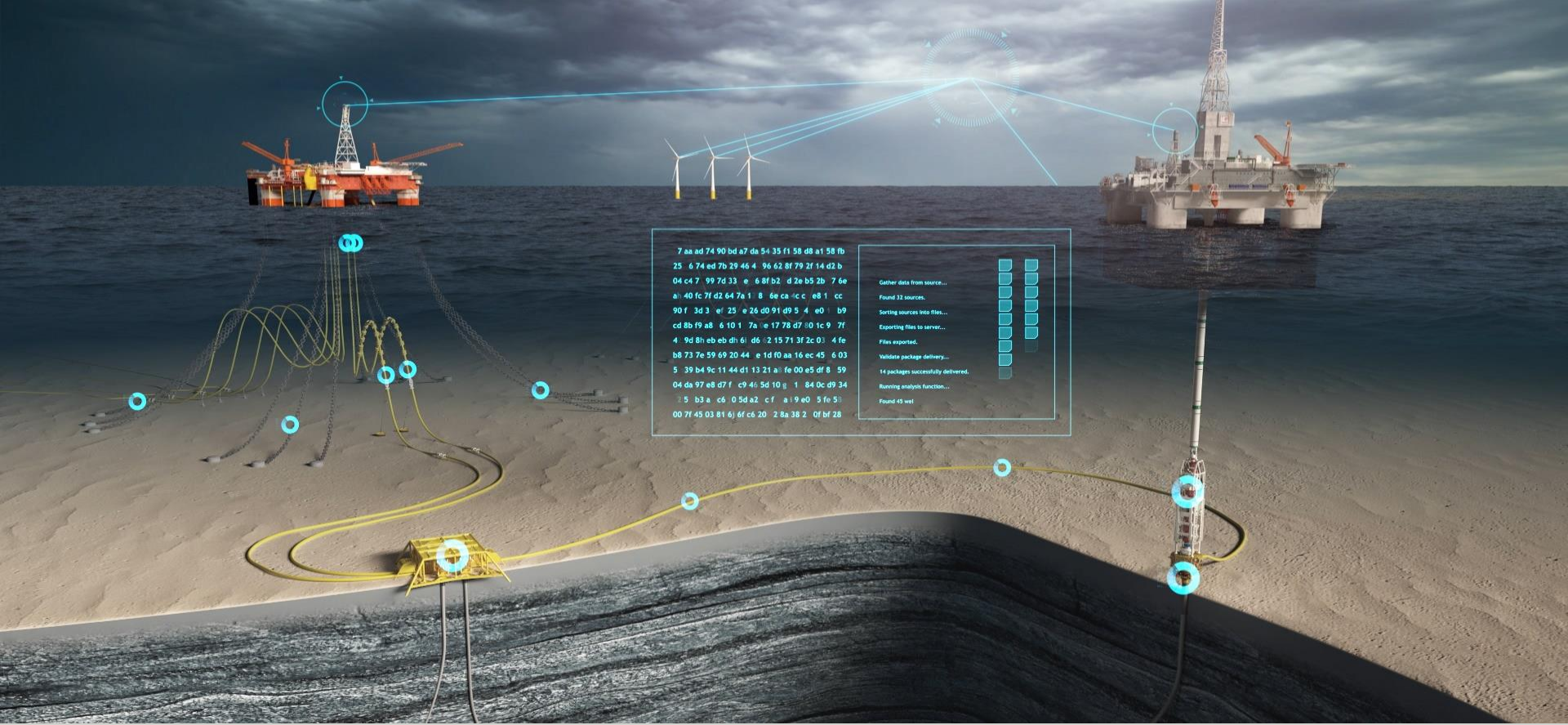

Thank you.

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