

# Improving flexible pipe integrity management through annulus vent gas monitoring

Seminar on flexible pipes, integrity management and aging, 26.11.25

# Topics

**01**

Why monitor annulus vent gas

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**02**

Monitoring system requirements

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**03**

Alarms and actions

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**04**

Short- and long-term data evaluation

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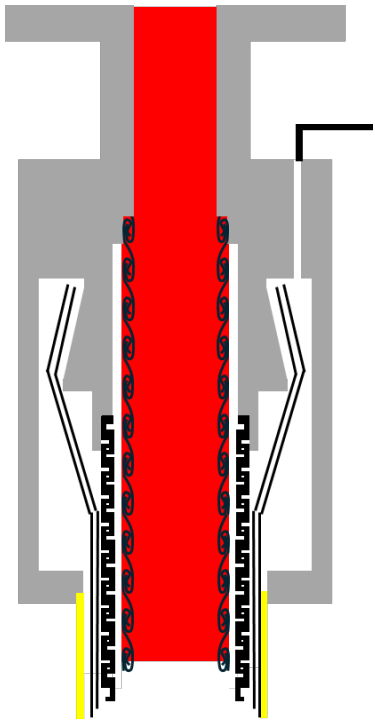
**05**

Remote annulus volume testing

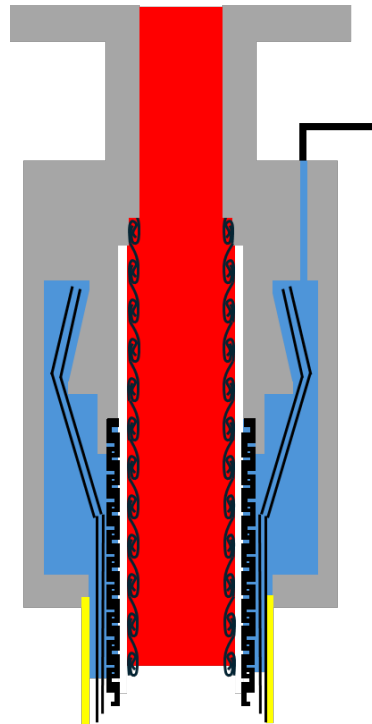
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# Why monitor annulus vent gas

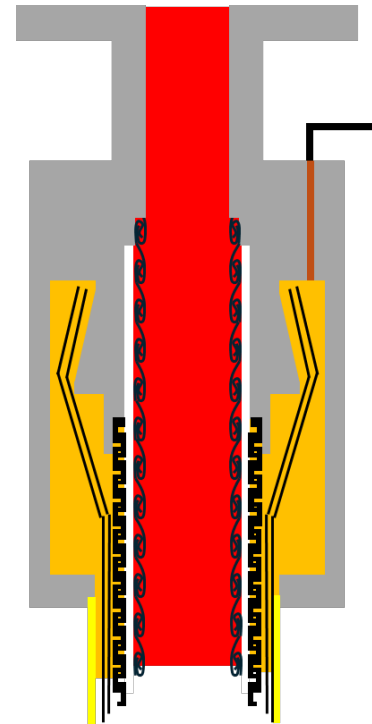
Normal



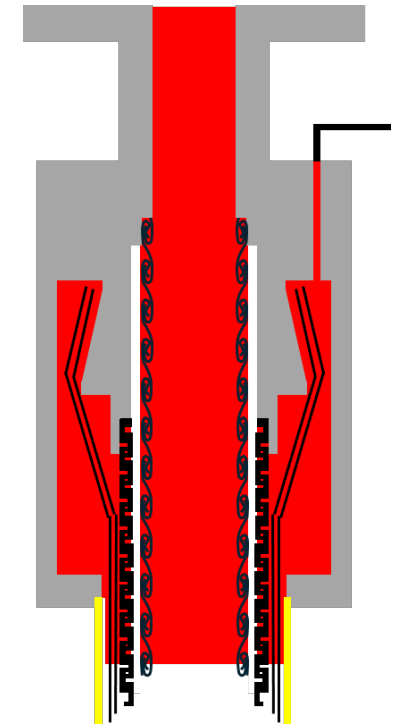
Annulus flooding



Restriction in vent path



Loss of containment



Outer sheath wear

Loss of EF sealing

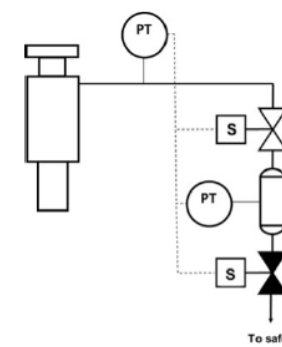
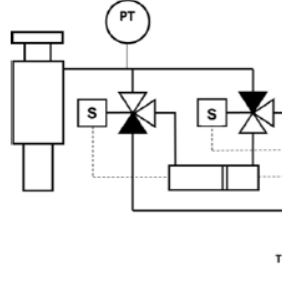
# Monitoring system requirements

- Key components
  - Pressure transmitter
  - Actuated valves
  - Reference volume or cylinder
  - Logic solver
- Monitoring parameters
  - Annulus pressure
  - Ventilated volume
- Calculated parameters
  - Vent flowrate
  - Free volume estimation

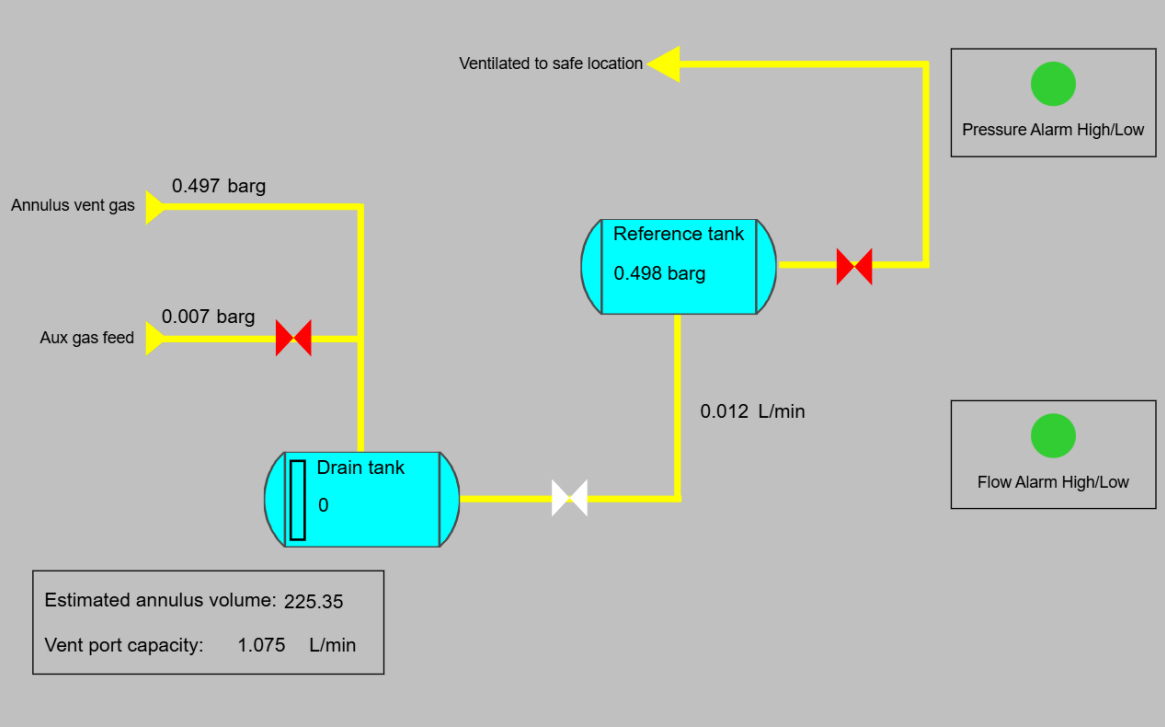
10 of installed

11 of installed

## IOGP Report 682

No	Main components	Setup	Monitoring parameters	Limitations
6		<ul style="list-style-type: none"> <li>• A reference volume is used as a flowmeter.</li> <li>• Actuated valves are operated to fill and empty a reference volume.</li> <li>• Time between each cycle is used to calculate vent flow rate.</li> <li>• Total vented volume is obtained by counting number of cycles.</li> </ul>	<ul style="list-style-type: none"> <li>• Annulus pressure</li> <li>• Vent flowrate</li> <li>• Vented volume</li> <li>• Free annulus volume can be estimated.</li> </ul>	<ul style="list-style-type: none"> <li>• Limited vent flow capacity due to cycle time.</li> <li>• Inaccurate instantaneous vent flow rate measurement for pipes with low permeation (accurate vent flow can be determined by long term trending of vented volume).</li> </ul>
7		<ul style="list-style-type: none"> <li>• A double acting piston which contains two reference volumes is used as a flowmeter.</li> <li>• The actuated valves are controlled when the reference volumes are filled and venting pressure is reached. End switches and springs may be one option.</li> <li>• Time between each cycle is used to calculate vent flow rate.</li> <li>• Total vented volume is obtained by counting number of cycles.</li> </ul>	<ul style="list-style-type: none"> <li>• Annulus pressure</li> <li>• Vent flow rate</li> <li>• Vented volume</li> <li>• Free annulus volume can be estimated.</li> </ul>	<ul style="list-style-type: none"> <li>• Same as 6.</li> <li>• Dynamic seal requires maintenance.</li> </ul>

# Alarms and actions



	Low pressure	Normal pressure	High pressure
Low flow	Outer sheath damage	Restriction in end fitting	Restriction in vent system
Normal flow	System fault	Normal condition	
High flow		Loss of containment	

Action required
Critical

# Short-term data evaluation

Insight

Search

Data Entry

Issues

Security

Admin

Release 1.13.25 Build id: 251124.1008

Alvheim

Edvard Grieg and Ivar Aasen

Skarv

Ula

Valhall

Yggdrasil

Delete

Edit

Add

Link

Attachments

Graph...

Activity log

Interval1

Start Date2020-01-01

ConditionRiser E6 Carcass bleed vent pressure

TypePressure

Next Status Update2025-11-26 11:00

Current Status Effective Date2025-11-25 11:00

Time Series (1)

Check Results (7)

Functional Locations (2)

Start	End	Max Duration	Description	Status	Acknowledgement
2024-10-23 08:13	2025-11-25 11:02	398d 3h 49m	Riser E6 Carcass bleed ve	PASSED	
2024-10-22 17:42	2024-10-23 08:13	14h 31m	Riser E6 Carcass bleed ve	FAILED	Annulus pressure exceeded no...
2023-11-07 21:28	2024-10-22 17:42	349d 19h 14m	Riser E6 Carcass bleed ve	PASSED	
2023-11-07 21:27	2023-11-07 21:28	1m	Riser E6 Carcass bleed ve	FAILED	Failed check due to setup of n...
2023-10-27 14:52	2023-11-07 21:27	11d 7h 35m	Riser E6 Carcass bleed ve	PASSED	
2023-10-27 14:49	2023-10-27 14:52	3m	Riser E6 Carcass bleed ve	FAILED	Failed check due to setup of n...

- Alvheim

Alvheim 12.5" gas export riser

Alvheim 12.5" water disposal riser I

Alvheim 8" gas lift riser

Boa 10.6" production riser

East Kameleon 9.6" production riser

Kneler A 10.6" production riser

Kneler B 10.6" production riser

Vilje 10.6" production riser

Volund 10.6" production riser
- Skarv

10" gas injection riser

12" gas export riser

12" gas export riser

Idun 10" production riser

Skarv A 10" production riser

Skarv A 10" production riser

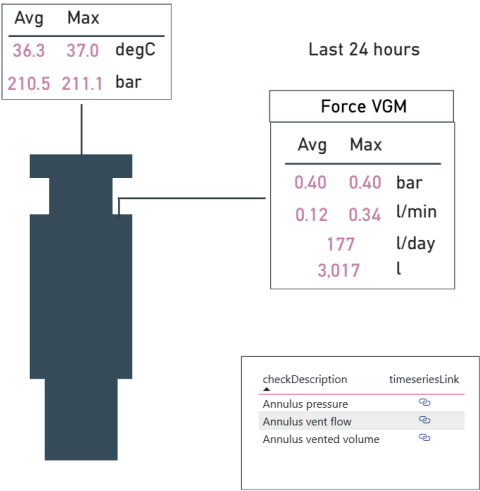
Skarv B/C 10" production riser

Skarv B/C 10" production riser

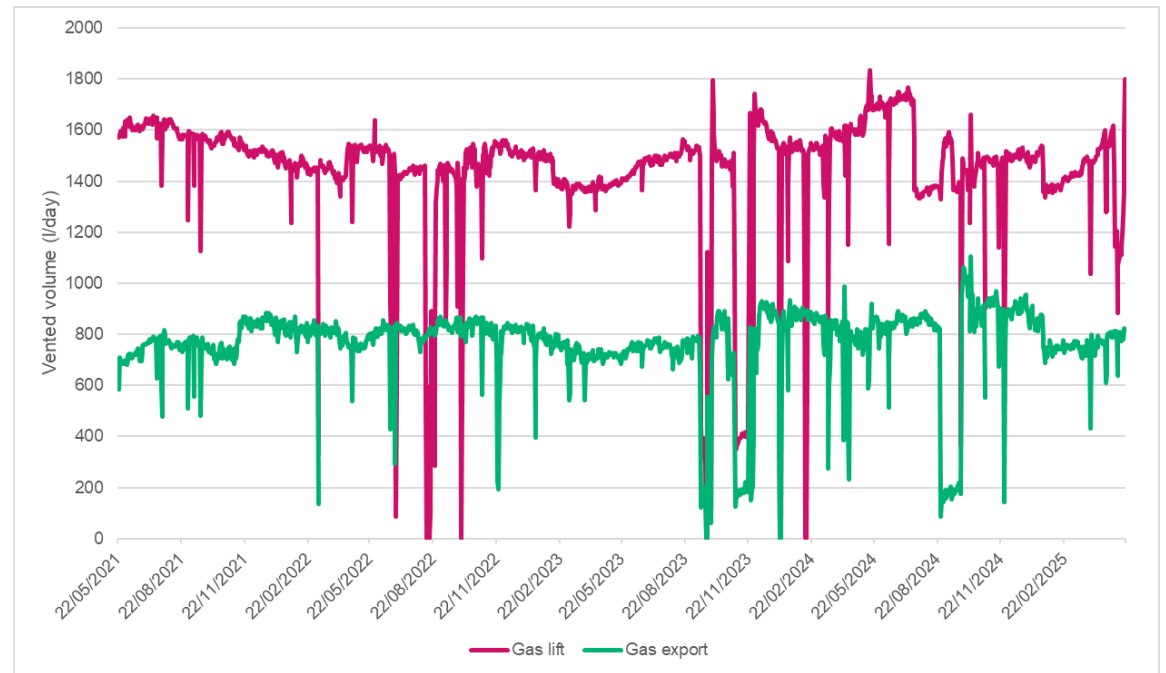
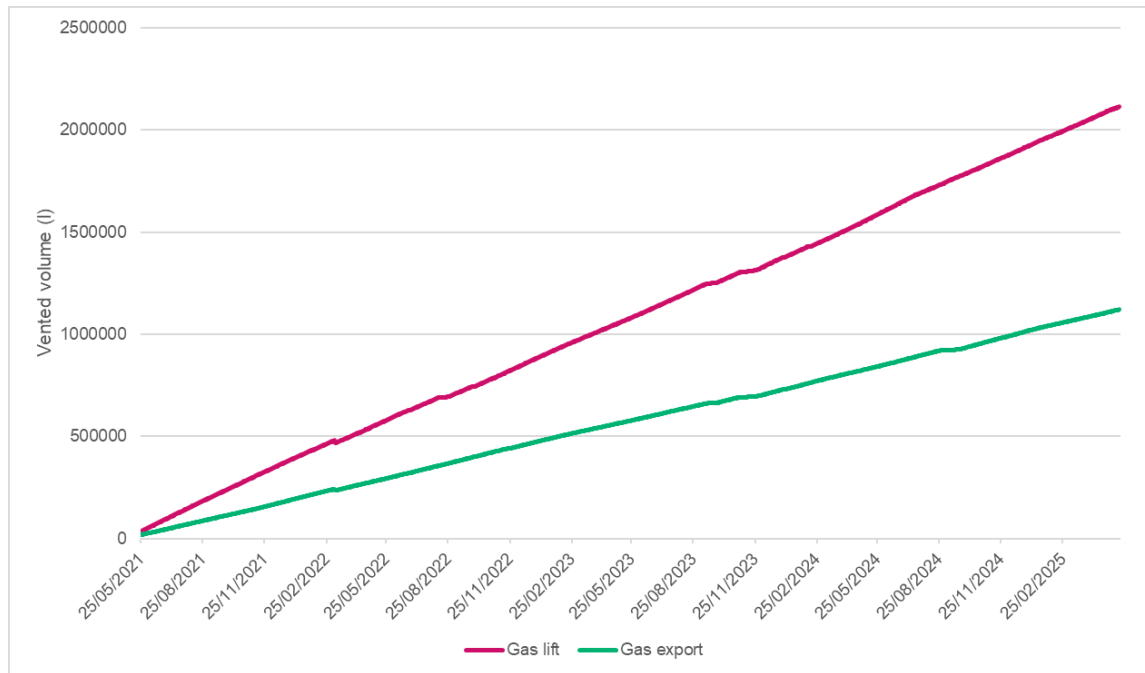
Tilje 8" production riser

Tilje 8" production riser
- Valhall

VFW 4in GL riser at VWP



# Long-term data evaluation



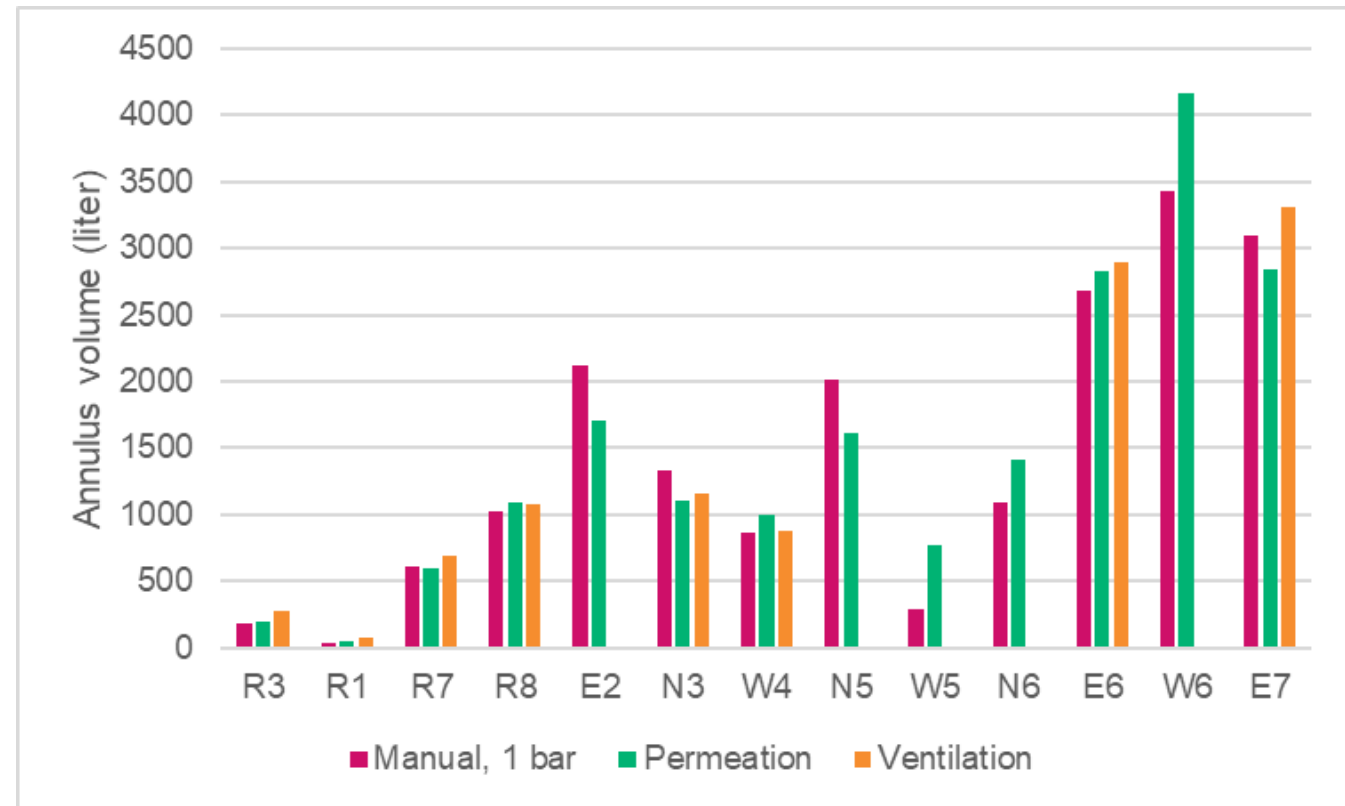
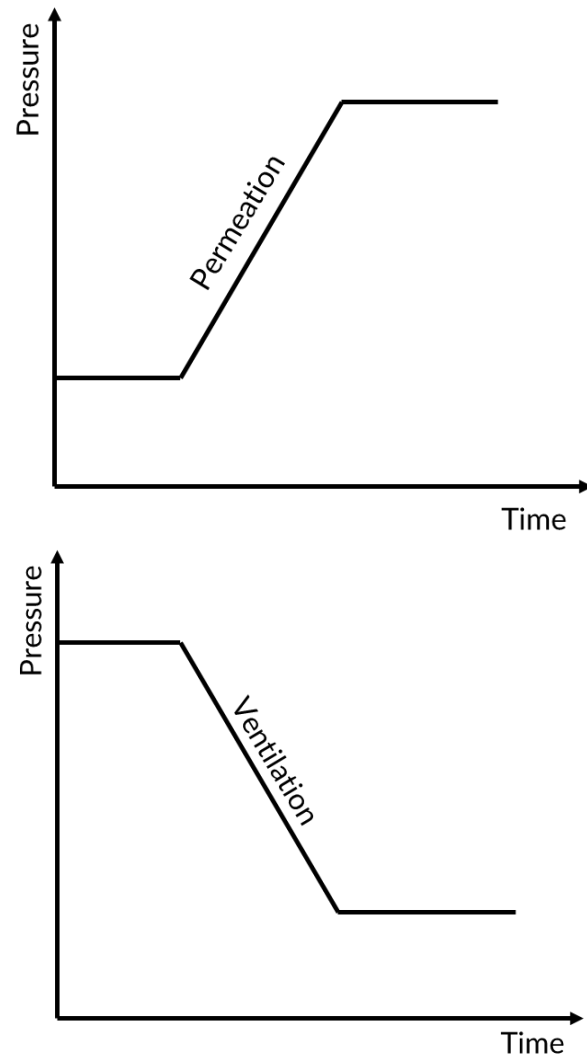
# Remote annulus volume testing

- Remote vs manual
  - Allow for increased test frequency
  - No need for mobilizing offshore personnel and equipment
  - Require stable conditions during testing
- Remote vs automatic
  - Perform test under stable conditions
  - Controlled by permit to work
  - Understanding of how system is working
  - Ensure system resumes monitoring

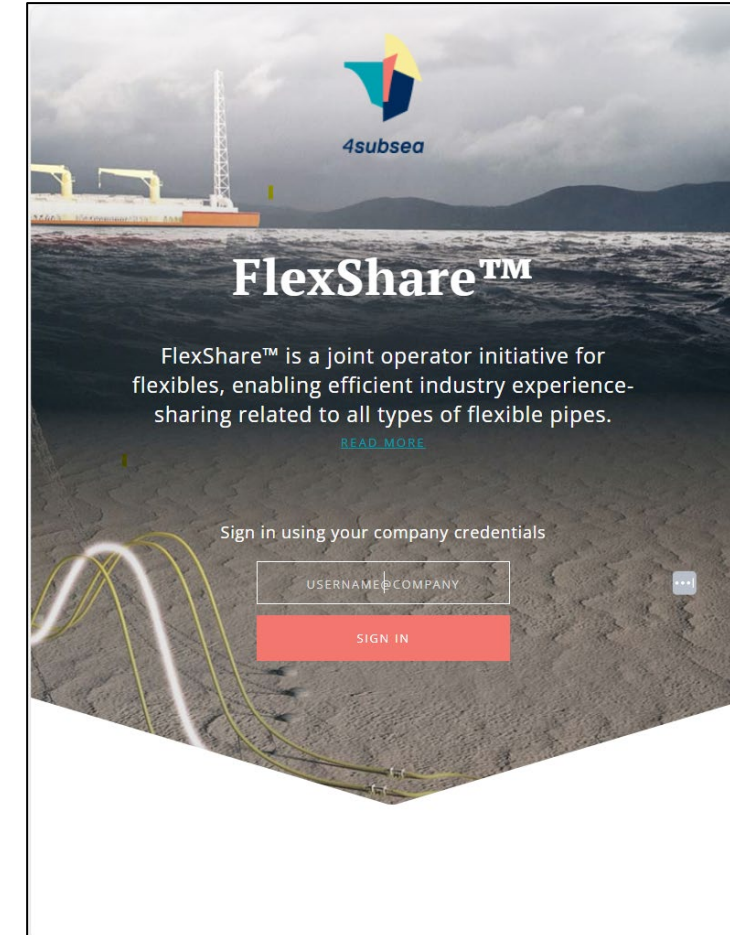
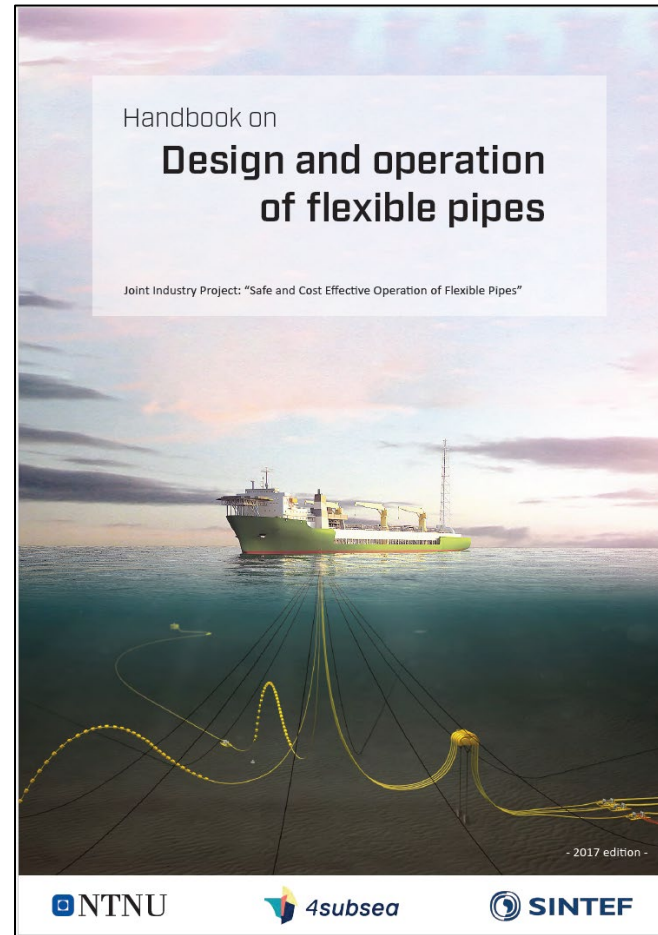




# Annulus volume estimation



# More about annulus vent gas monitoring





[www.akerbp.com](http://www.akerbp.com)