

Welcome to PP&A Seminar 2024

New Technology and verification of barriers

Introduction by Finn Carlsen
Director of Professional Competence
Norwegian Ocean Industry Authority

Plug and Abandonment seminar 2024

New technology and verification of barriers

09:00 – 09:10 **Welcome & Introduction**

09:10 – 09:40 Updates from HAVTIL PP&A

09:40 – 10:00 Qualification of PWC technology

10:00 – 10:20 Verification of PWC cement intervals

10:20 – 10:45 **Coffee Break**

10:45 – 11:05 New barrier materials low CO₂-footprint

11:05 – 11:25 Electrically Deployed Bismuth Alloy Barrier

11:25 – 11:45 New technology for verification of WBE

11:45 – 12:30 **Lunch break and Networking**

12:30 – 12:50 Status on Barrier Capacity Project

12:50 – 13:10 NORCE P&A Innovation program (stack)

13:10 – 13:30 Verification and accept criterias isolation

13:30 – 13:55 **Coffee break**

13:55 – 14:15 Wireless monitoring of well barriers

14:15 – 14:30 WRAP-UP (What did we learn/share today)

Finn Carlsen & Monica Ovesen, Havtil

Nina Ringøen, PP&A gruppen, Havtil

Erlend Engelsgjerd, Hydrawell

Petter Erland, Conocophillips

Mahmoud Khalief, UIS

Gert Rege, Wellstrøm/Total

Bernt Pedersen, Exedra

Stein Åtland, Equinor

Erlend Randeberg, NORCE

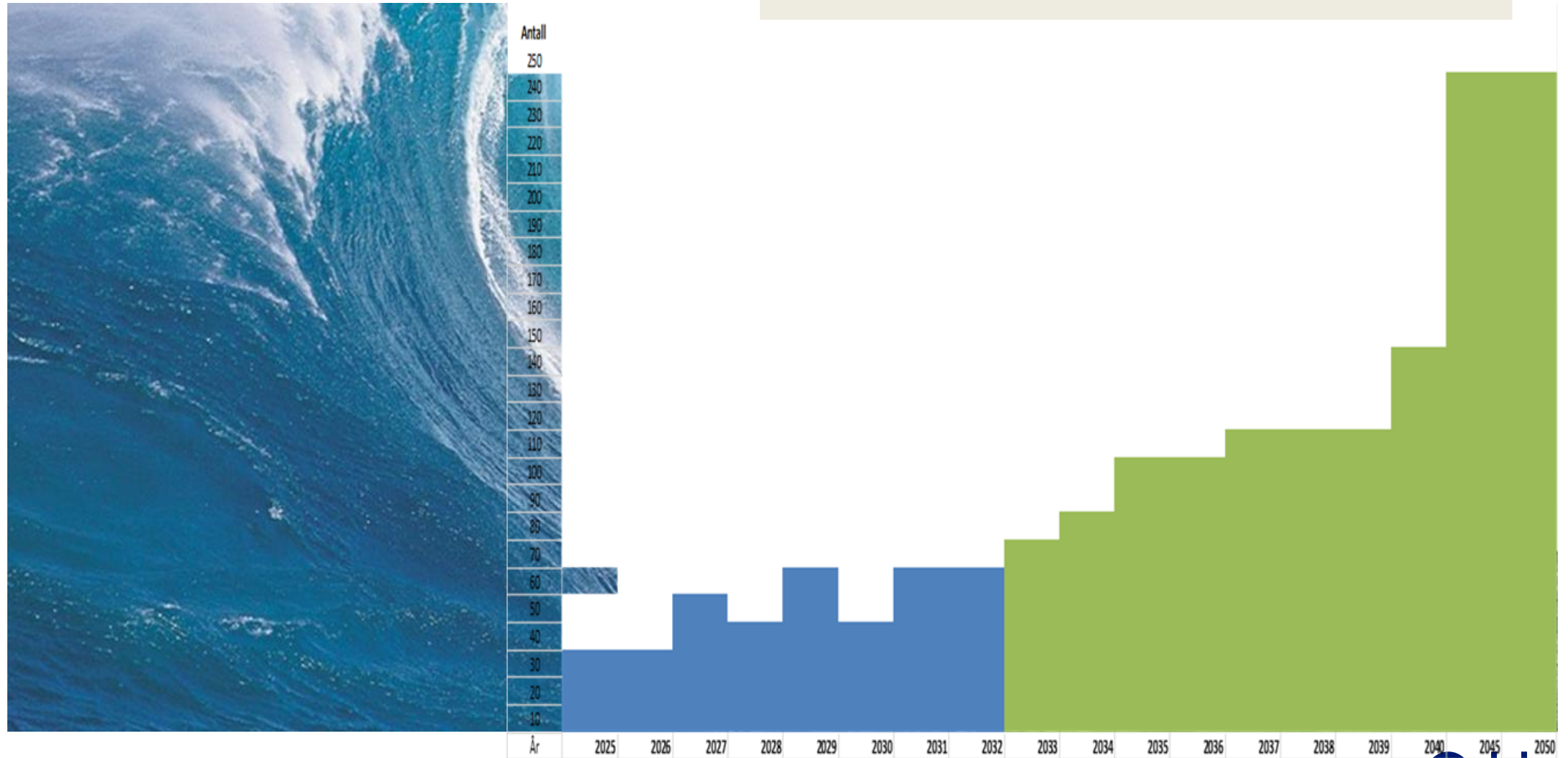
Laurent Delabroy, Aker BP

Thomas Karlsen, ICONIC

Nina Ringøen, Havtil

Are we ready ?

Outlook 2025 to 2050





Updates from HAVTIL 2024

Sector task plugging and abandonment

Seminar theme: New technology and verification of barriers



HAVTIL's Key duties

Regulations

- Develop, assess and maintain HSE regulations for NCS

Supervision (supervisory authority)

- Supervise the companies through audits, dialogue e.g

Build knowledge (directorate)

- Acquire, administer and communicate knowledge which contributes to continuous improvements in the ocean industry sectors

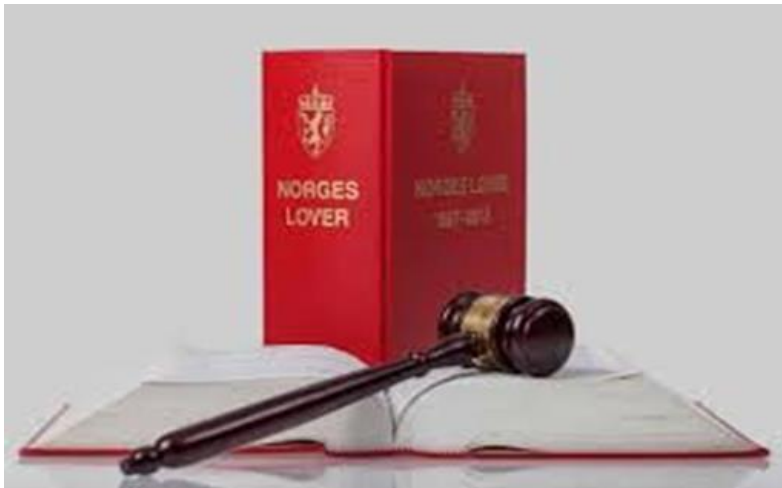
Advice

- Provide specialist advice to the ministry of Energy

Our Regulations

Petroleum operations

- Framework regulations
- Management regulations
- Activities regulations
- Facilities regulations
- Technical and operational regulations
- Regulations pursuant to the Working Environment Act



CO₂ transport and injection

- CO₂ safety regulations (2020)

Renewable energy production offshore

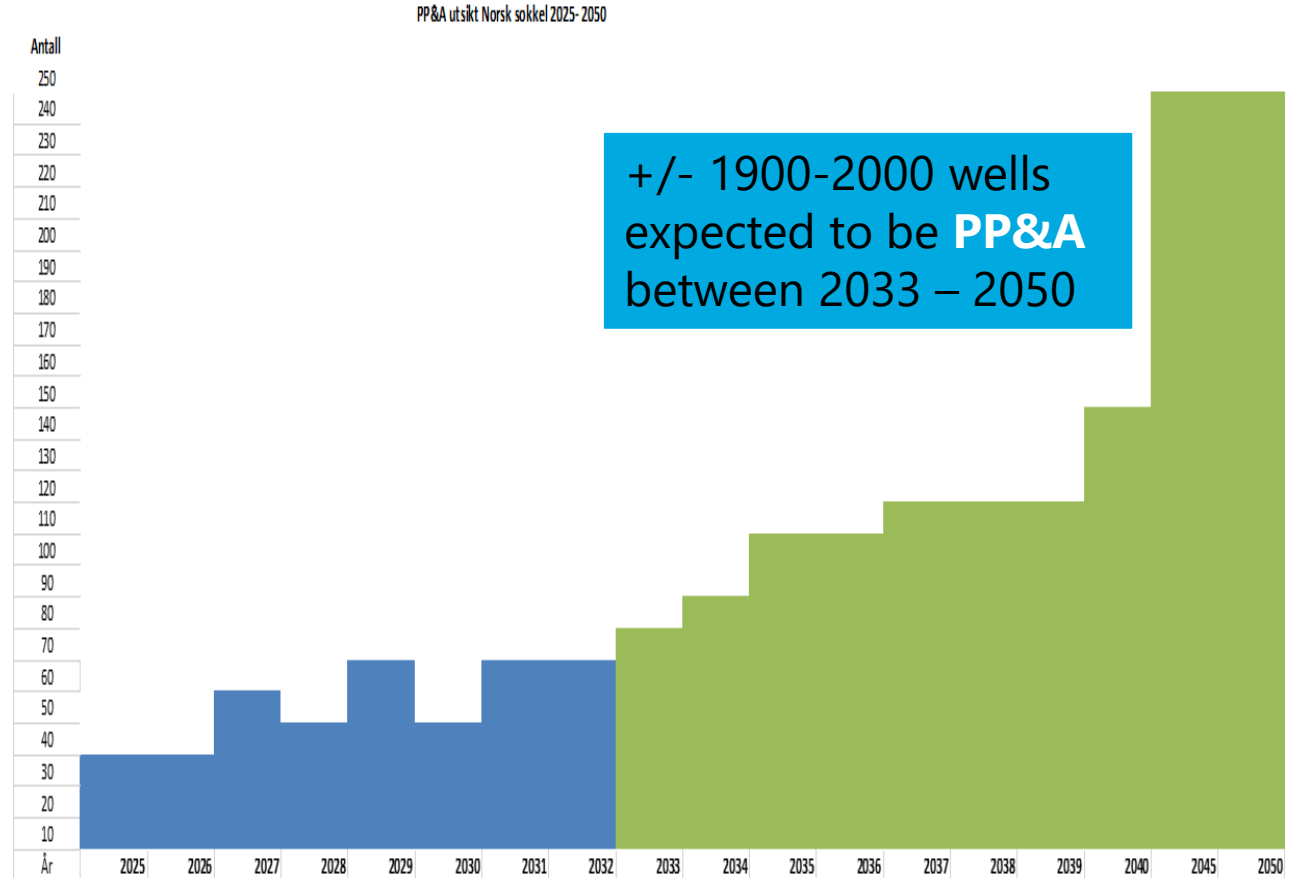
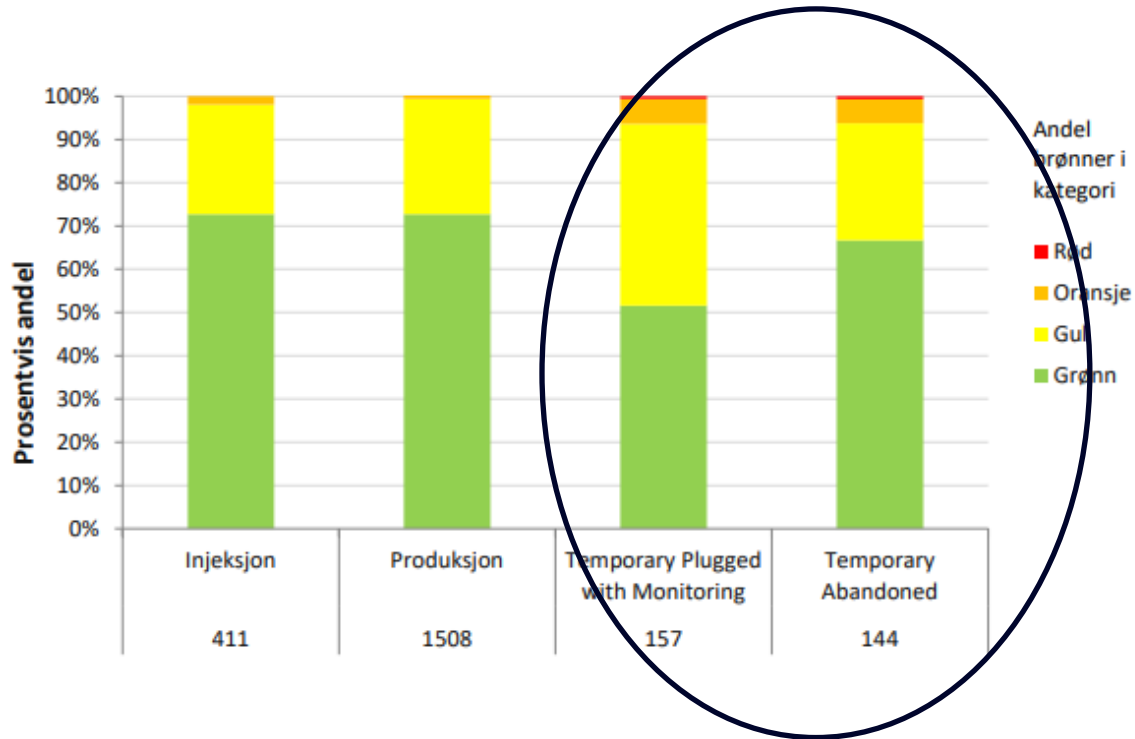
- Draft regulations on safety and the working environment when producing renewable energy at sea have been issued for consultation (on a hearing)



Total number of wells NCS January 2024

+/- 2245 wells

1.1.2024

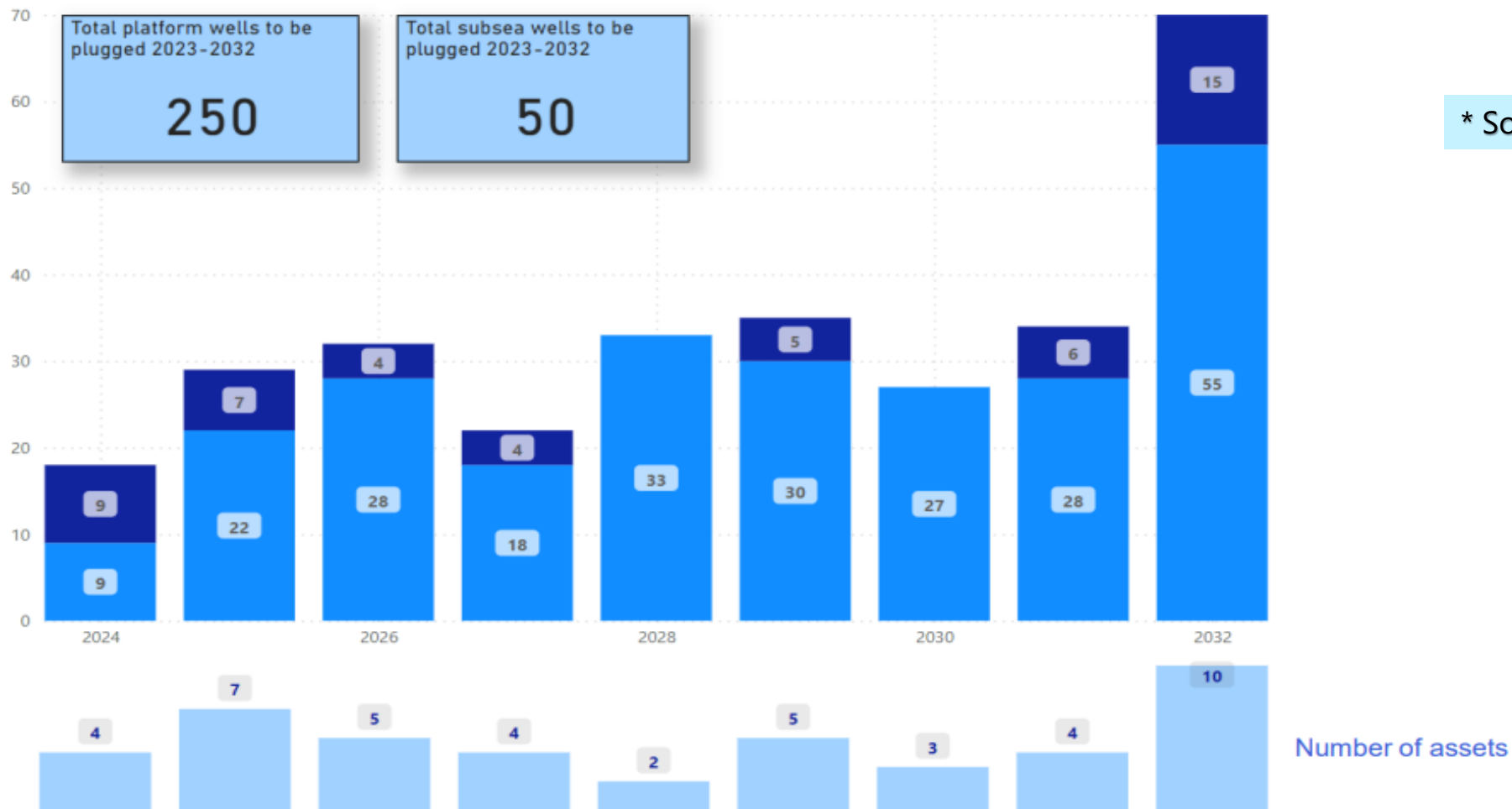


WELLS DECOMMISSIONING OUTLOOK to 2032



Expected P&A Wells (Subsea and platform) - Survey year 2023

● Platform wells ● Subsea wells ● Suspended Subsea E&A Wells

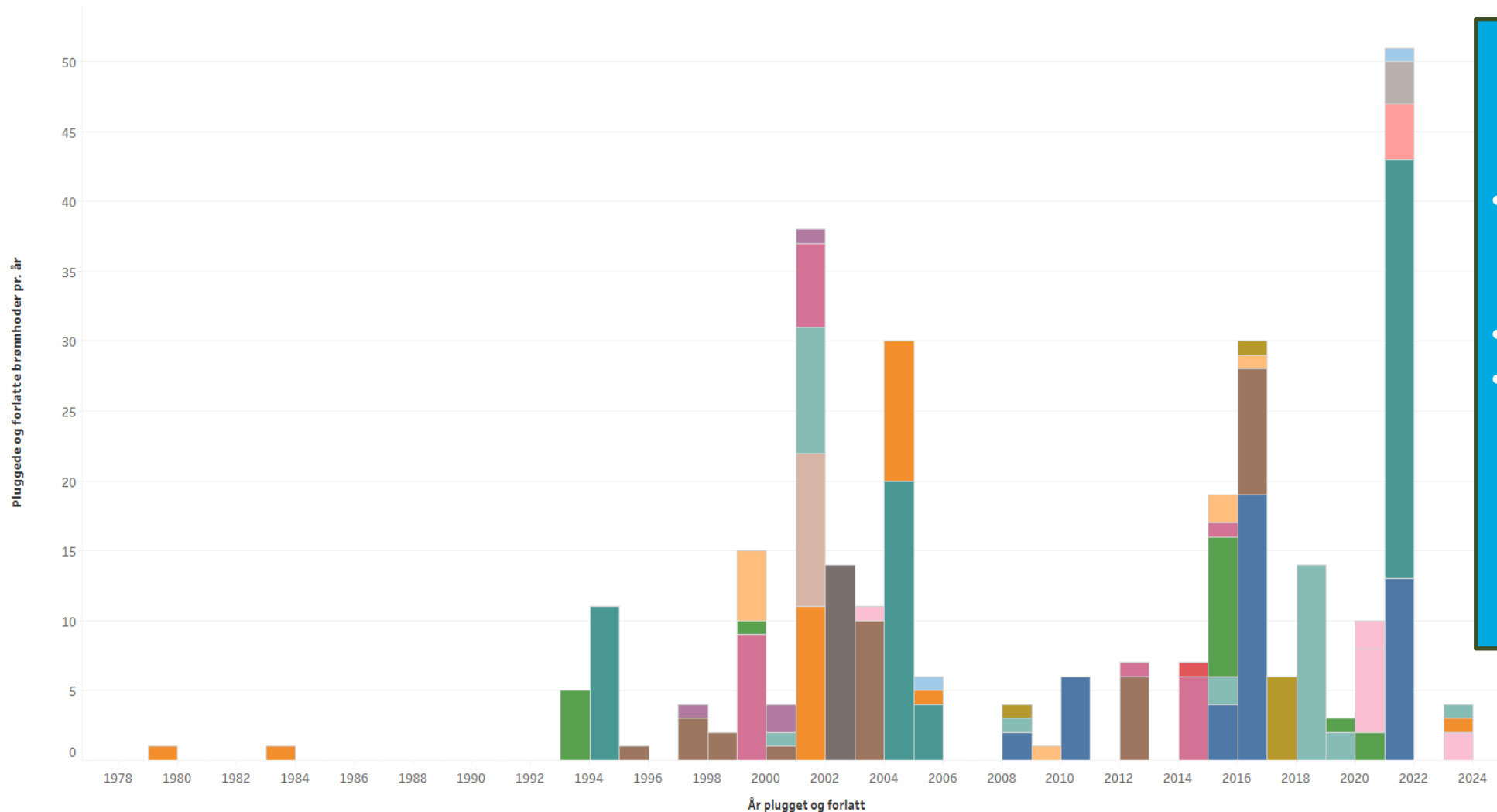


* Source Offshore Norge

There are 250 platform wells and 50 subsea wells planned against 234 platform wells and 29 subsea wells indicated last year.

Permanent P&A of production wells NCS 1978 – 2023*

Pluggede og forlatte brønnhoder pr. år - Utvinningsbrønner
Oppdatert: 24.01.2024 14:17:47



- **461** production wells are PP&A
- In addition to
- **+/- 2000** Exploration wells PP&A

Activity Regulations § 88 Securing of wells



All wells shall be secured before they are abandoned so that well integrity is safeguarded during the time they are abandoned.



For subsea-completed wells, well integrity shall be monitored if the plan is to abandon the wells for more than twelve months.



Exploration wells commenced after 1.1.2014 shall not be temporarily abandoned beyond two years.



In production wells abandoned after 1.1.2014, hydrocarbon-bearing zones shall be plugged and abandoned permanently within three years if the well is not continuously monitored.



It shall be possible to check well integrity in the event of reconnection on temporarily abandoned wells.

Activity Regulations § 85 Wellbarriers



During drilling and well activities, there shall be tested well barriers with sufficient independence.



If a barrier fails, activities shall not be carried out in the well other than those intended to restore the barrier.



There shall be pumping and fluid capacity available on the facility or on vessels in the event of heavy well intervention. The need for pumping and fluid capacity in the event of light well intervention shall be included in the activity-specific risk assessment.



When handing over wells, the barrier status shall be tested, verified and documented.

Facility Regulations § 48 Wellbarriers

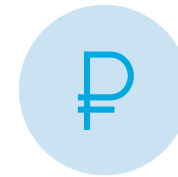
The well barriers shall be designed such that their performance can be verified.



Well barriers shall be designed such that well integrity is ensured, and the barrier functions are safeguarded during the well's lifetime.



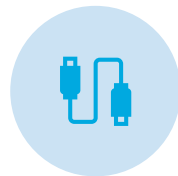
Well barriers shall be designed such that unintended well influx and outflow to the external environment is prevented, and such that they do not hinder well activities.



When a production well is temporarily abandoned without a completion string, at least two qualified and independent barriers shall be present.



When a well is temporarily or permanently abandoned, the barriers shall be designed such that they consider well integrity for the longest period of time the well is expected to be abandoned.



When plugging wells, it shall be possible to cut the casings without harming the surroundings.



The well barriers shall be designed such that their performance can be verified.

Temporary plugged and abandon wells

- Bi- annual surveys performed 2011 with integrity colour coding
 - Ref. to Norsok D-010 definitions for temporary abandon wells
 - Ref. to Offshore Norway guideline 117 for well integrity status
- 2024 completed in March 2024 –Quality assurance ongoing
 - Have included production/injection wells that have been shut in for more than 1 year

Category	Principle
Red	One barrier failure and the other is degraded/not verified, or leak to surface
Orange	One barrier failure and the other is intact, or a single failure may lead to leak to surface
Yellow	One barrier degraded, the other is intact
Green	Healthy well - no or minor issue

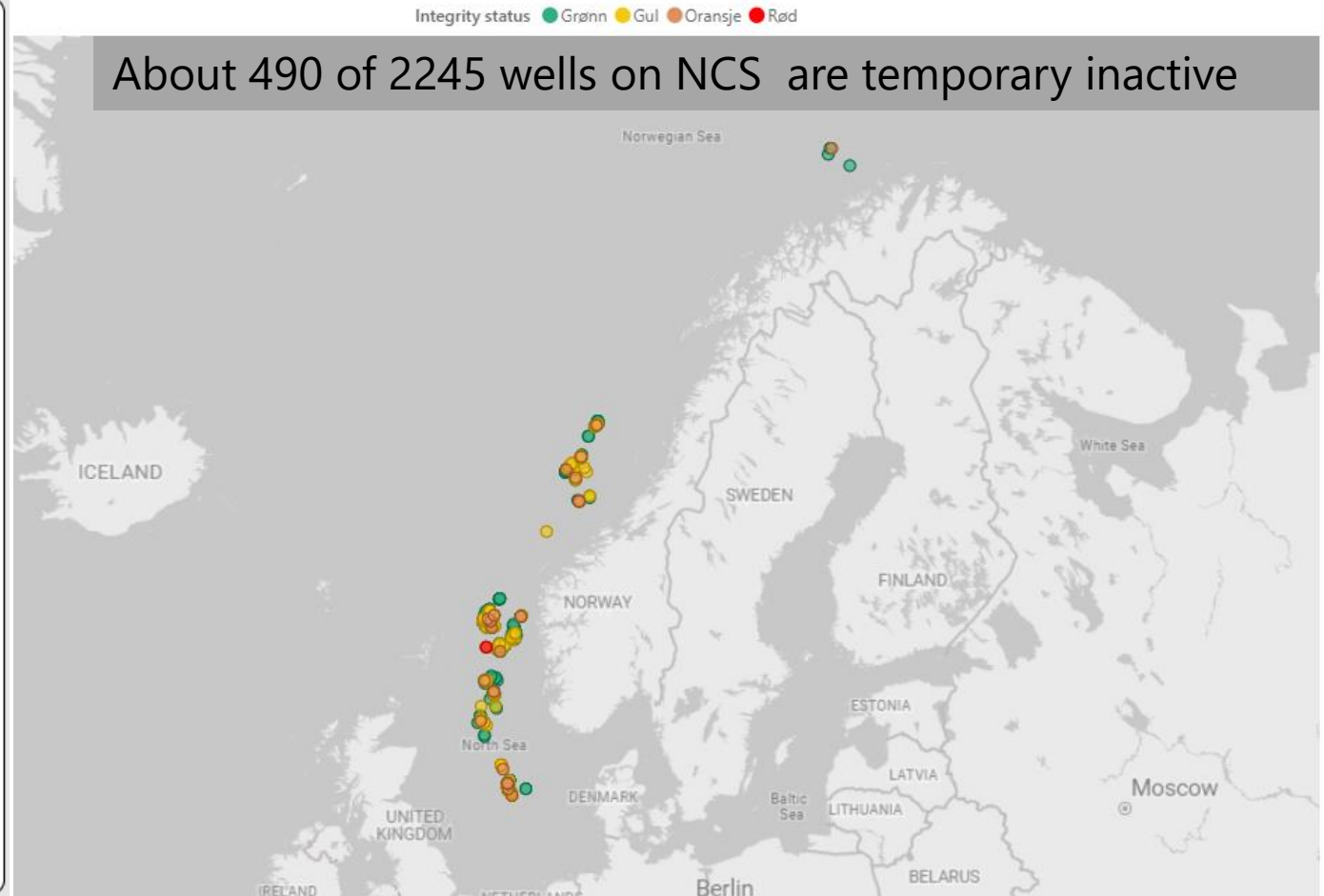
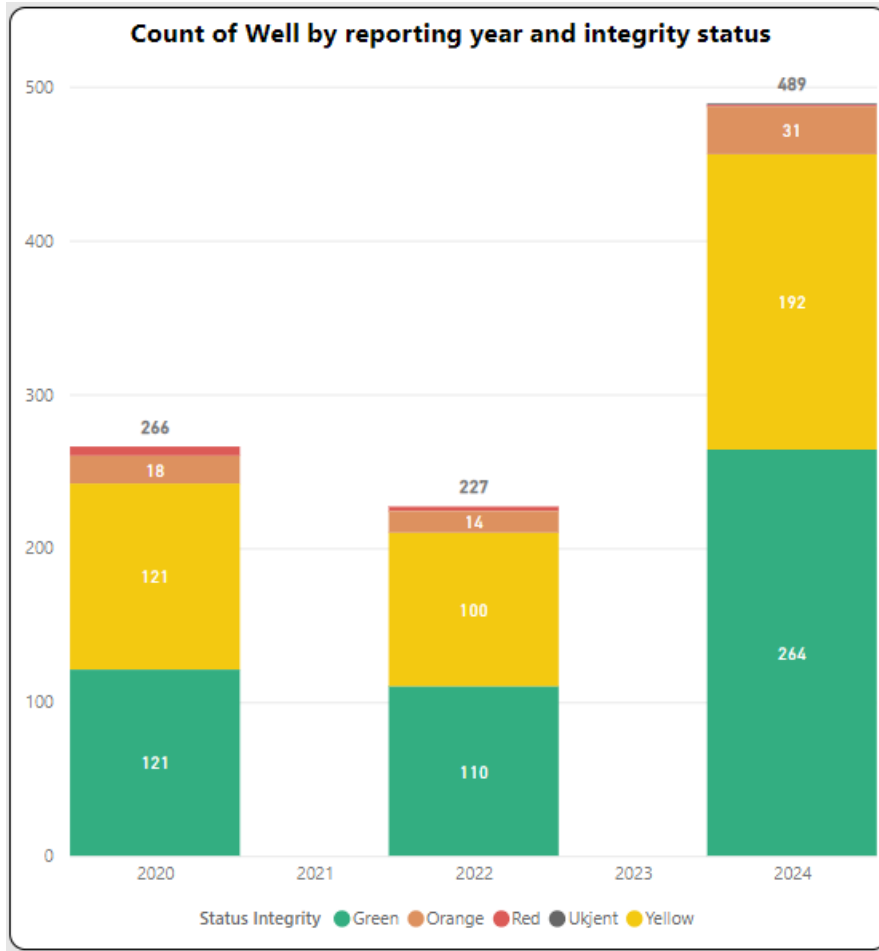
Temporary abandonment – with monitoring;

Primary and secondary well barriers are continuously monitored and routinely tested. There is no time limit for this modus.

Temporary abandonment – without monitoring;

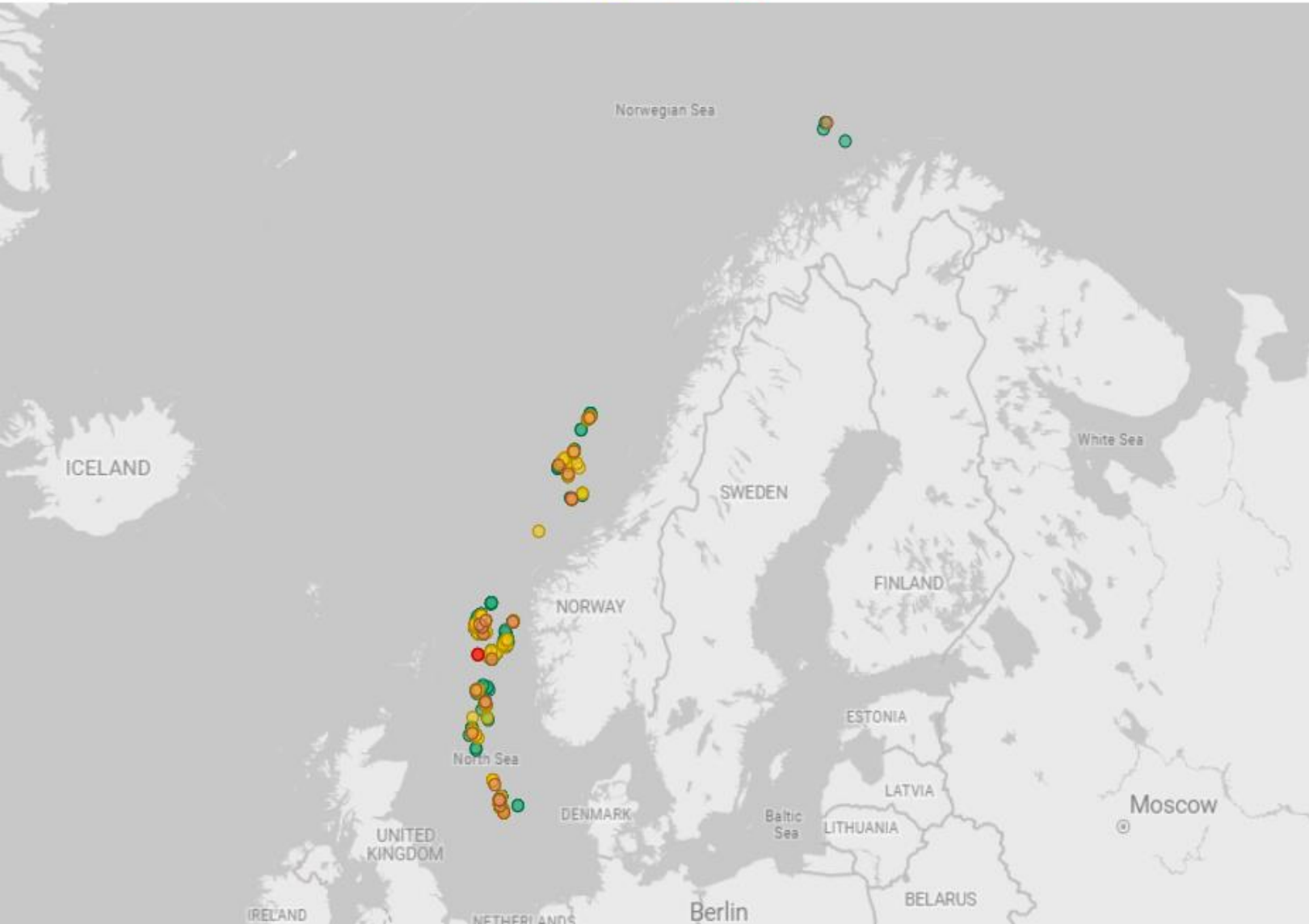
Primary and secondary well barriers are not continuously monitored nor routinely tested. The abandonment period shall not exceed three (3) years.

Temporary abandoned wells 2024 - Ongoing

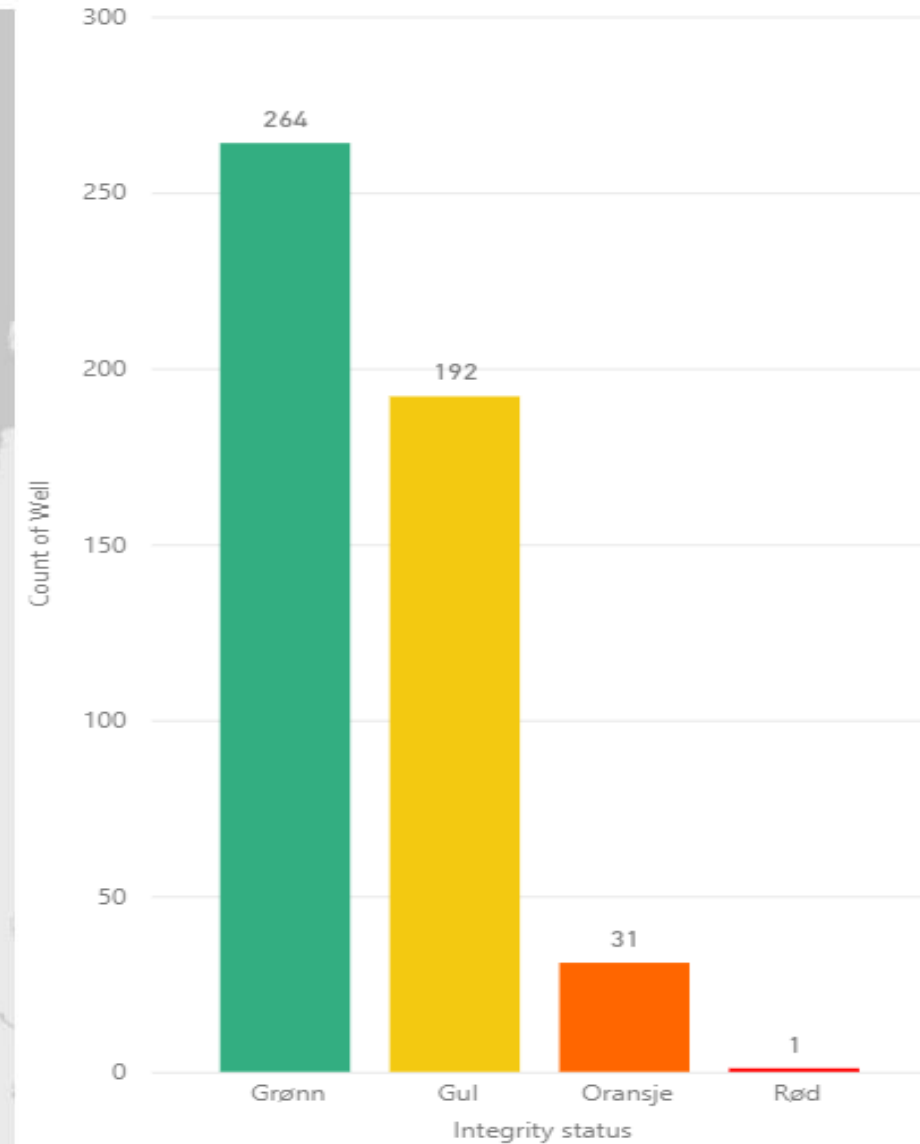


High level analysis

Integrity status ● Grønn ● Gul ● Oransje ● Rød



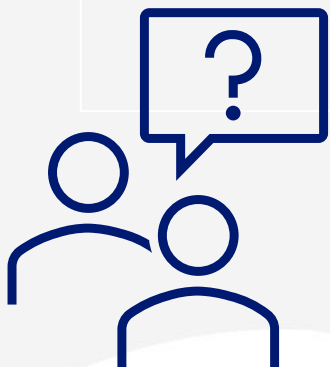
Count of Well by Integrity status



Facility Regulations § 9

Qualification of new technology and new materials

TRL-process
API 17N



New technology as mentioned in the first subsection, may be new products, new materials, analysis tools or known products used in a new way.

Criteria's shall be drawn up for

- **Development,**
- **Testing and**
- **Use**

Includes investigation and obtaining objective proof that the needs for a specific intended use are covered.

The qualification or testing shall demonstrate that applicable requirements can be fulfilled.

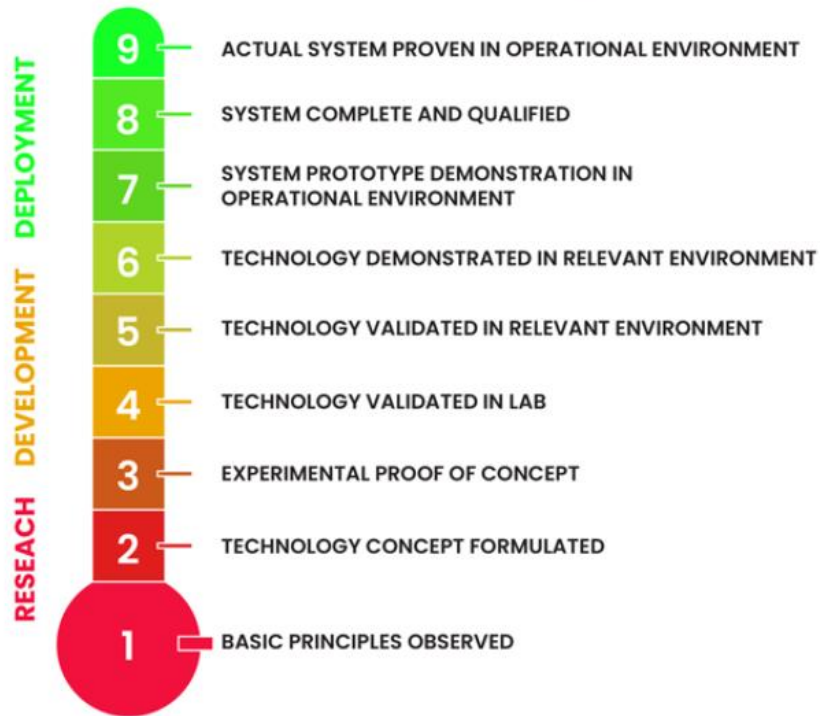
The technology or methods shall be adapted to already accepted solutions (*Verification /best practice*)

Guidance Level:
DNVGL RP-A203 and Oil & Gas UK Guidelines Use of Barrier Materials in Well Decommissioning Guidelines

Technology Readiness Levels

Technology Readiness Levels (TRL) are a type of measurement system used to assess the maturity level of a particular technology.

US DoD



API 17N

7	Field Proven Production system field proven
6	System Installed Production system installed and tested
5	System Tested Production system interface tested
4	Environment Tested Pre-production system environment tested
3	Prototype Tested System function, performance and reliability tested
2	Validated Concept Experimental proof of concept using physical model tests
1	Proven Concept Proof of concept as a paper study or R&D experiments
0	Unproven Concept Basic R&D, paper concept

Development phases



Idea

Concept

- Observations
- Experiences



Analysis

Selection of criteria to be met

- Regulations
- Standards

Guidance

- EU directives
- Norwegian regulation (FR §9)
- Standards



Model testing/
Validation

Map challenges and uncertainties

- Control system needs
- Specifications
- Procedures for installation and maintenance
- Mapping of failure modes



Prototype
qualification

Prove compliance with criteria

- Success criteria
- Further iterations needed?
- Documentation

Guidance

- MR §21
- ISO 9000 and 9004

Development phases (continued)



Full scale qualification

Prototype

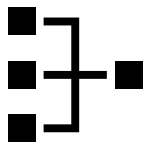
- Failure modes
- Iterations/reduce uncertainty



Field qualification

Product

- Milestones



System qualified

Qualified product

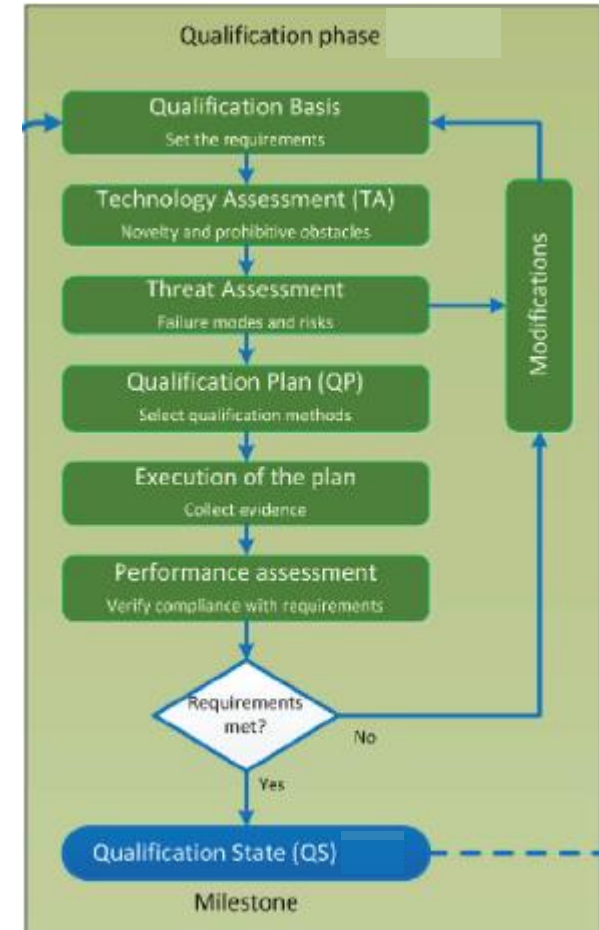
- Specifications



Field proven

Production

- Success criteria
- Further iterations needed?
- Documentation



Source: DNV RP-A203

EU Regulation on Methane Emissions

- Inventory list for all wells listed below to be prepared **12 months** after Regulation is published
- Quantification of methane leaks (emission) after **21 months - thereafter yearly**

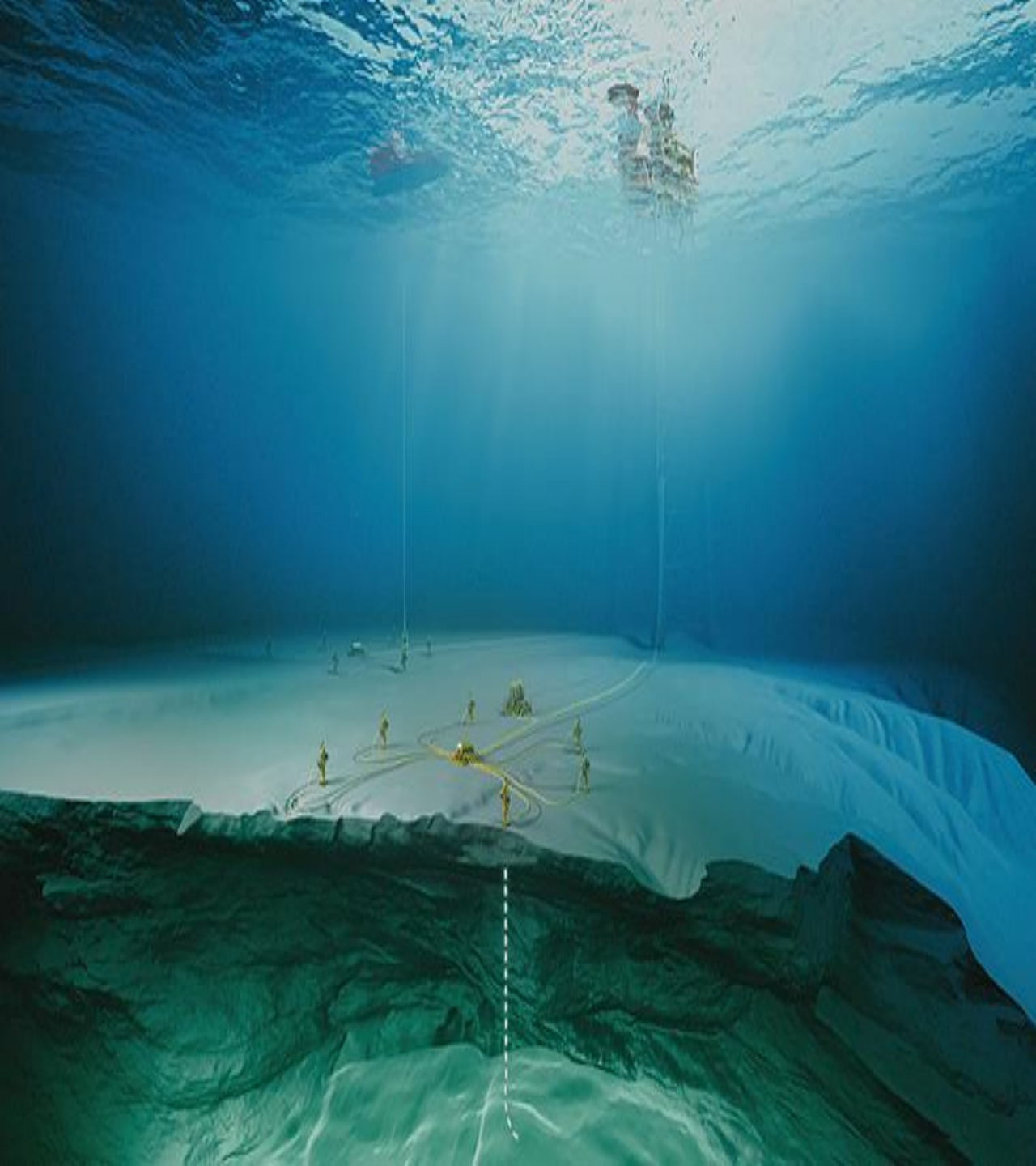
Inactive and Temporary plugged wells with a methane leak to be repaired (permanent plugged) within 3 (three) years.

- **Permanent plugged and abandoned wells**
 - Will no be re-entered again.

For Norway EEA relevance need to be decided by Ministry of Energy after June 2024



EU Objective: Reduce methane emissions from fossil energy produced or consumed in the union



Havtil CO₂ Safety Regulations §17

The regulations apply to exploration for and exploitation of subsea reservoirs for storage of CO₂ and transport of CO₂ to such reservoirs

-in areas subject to Norwegian jurisdiction.

§ 17 Drilling and well systems and drilling and well activities

[Share link](#)

PSA CO2 Safety Regulations §17

The requirements that apply to drilling and well systems in [Chapter VIII of the Facilities Regulations](#) and to drilling and well activities in [Chapter XV of the Activities Regulations](#), apply correspondingly to the scope of these regulations.

Last changed: 25 February 2020

[Guidelines and audit reports with nonconformities related to the section](#) →

Havtil CO₂ Safety Regulations

§11

§ 11 Matters relating to safety and working environment in the plan for development and operation of a subsea reservoir for injection and storage of CO₂ and specific licence for the installation and operation of facilities for transport

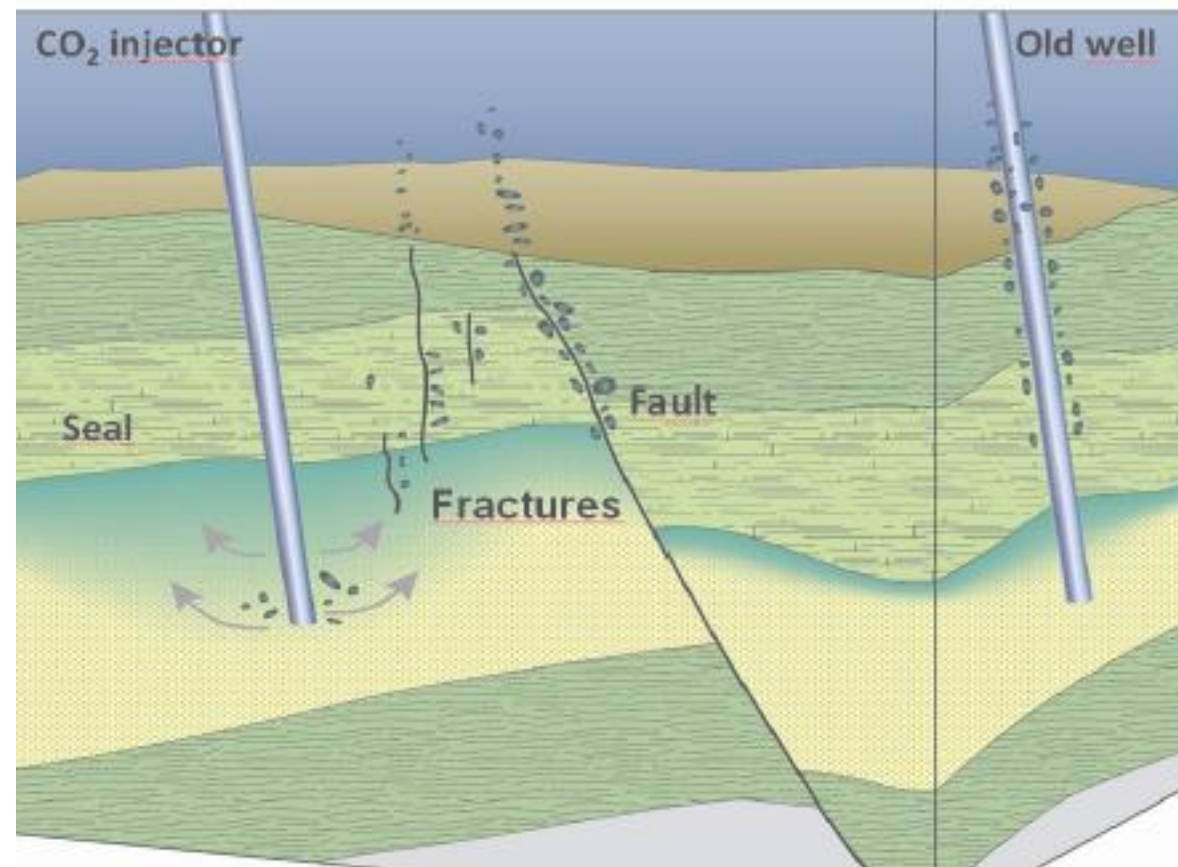
[Share link](#)

In addition to the account required by [Sections 4-6 and 6-2 of the Regulations relating to storage and transport of CO₂ on the shelf](#), the plan for the development and operation of subsea reservoirs for the injection and storage of CO₂ and specific licence for installation and operation of facilities for transport include an account of matters that are important for safety and the working environment as mentioned in [Section 27 of the Framework Regulations](#).

The consequences for the well barriers of existing wells in the CO₂ storage complex shall be accounted for.

Last changed: 25 February 2020

[Guidelines and audit reports with nonconformities related to the section](#) →



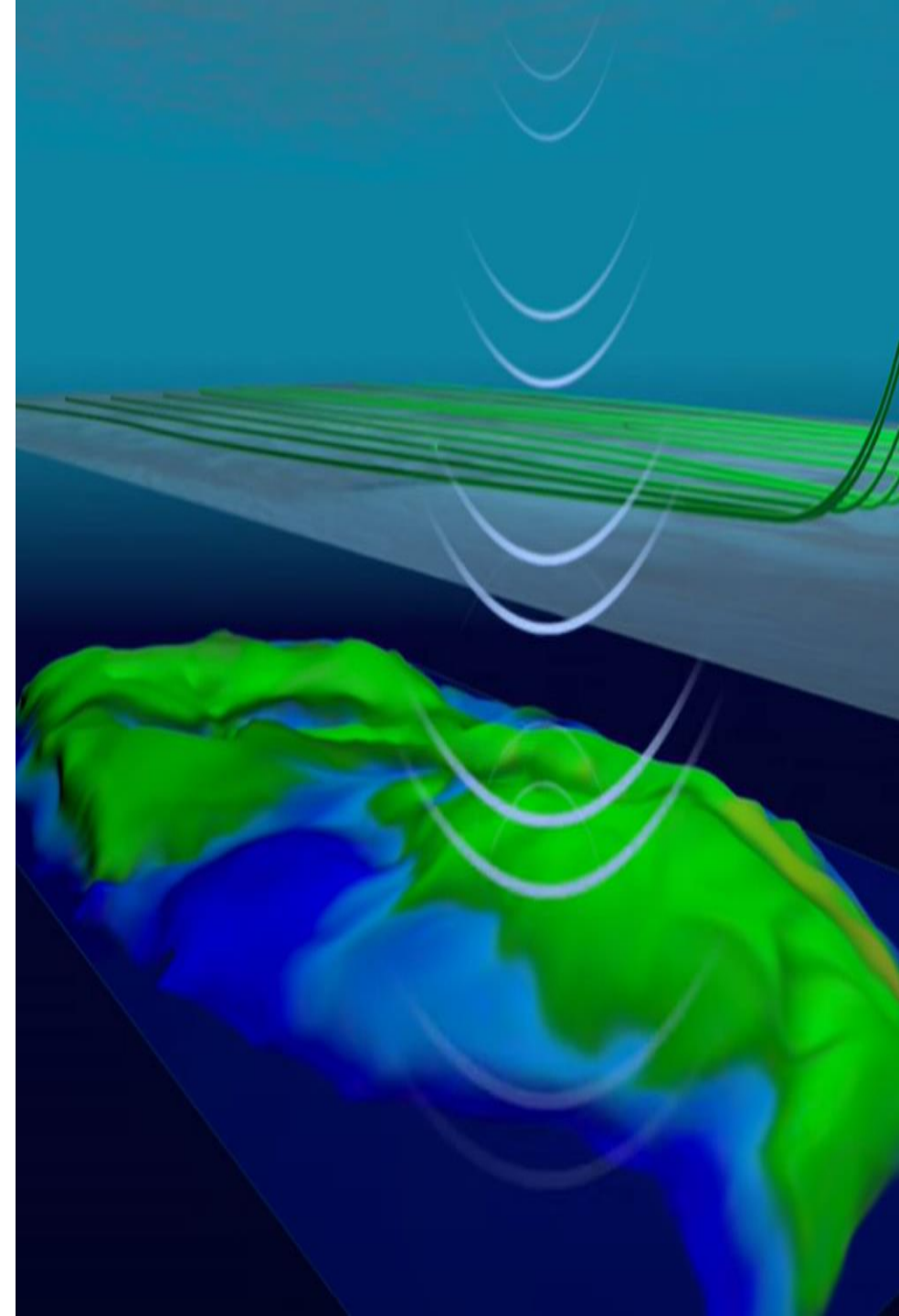
NOD regulations on storage and transportation of CO₂

§ 5-4 MONITORING

The operator shall **monitor the injection facilities and the storage complex, including the dispersion of CO₂** in order to:

- Compare the actual and modeled behavior of the CO₂ and the formation water in the storage location,
- Identify significant irregularities,
- Follow the migration of CO₂,
- Detect leaks of CO₂ from the storage complex
- Update the assessment of the storage complex' safety and integrity over the short and long term, including whether the stored CO₂ will remain safely stored.

It is mainly 4D seismic that is used to monitor the spread of CO₂



PP&A Seminar 2024