PETROLEUM SAFETY AUTHORITY NORWAY

Regulatory update with focus on Qualification of new technology & new materials including status of Temporary plugged wells

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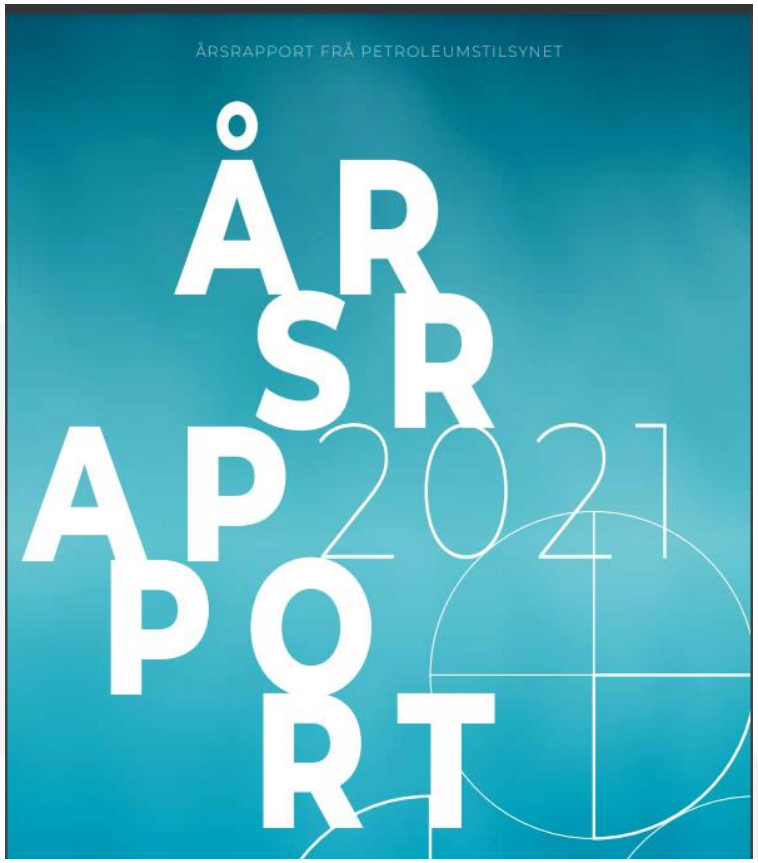
PAF Seminar 20th of October 2022
Drilling & Well Technology
Petroleum Safety Authority Norway



Annual report 2021 – production, plans and pandemic

The year 2021 was a time when gas prices reached new heights, the Norwegian continental shelf (NCS) produced at full pitch and government export revenues from petroleum set a new record.

PLUGGING & ABANDONMENT

Several fields on the NCS are now brown fields and at the end of their life cycle and will be **permanently plugged and abandoned in the years to come.**

For every year that goes by without the **innovative focus on development and qualification of new technology for permanent plugging**, the industry loses important **experience and learning** which are important for **efficiency** and costs**.**

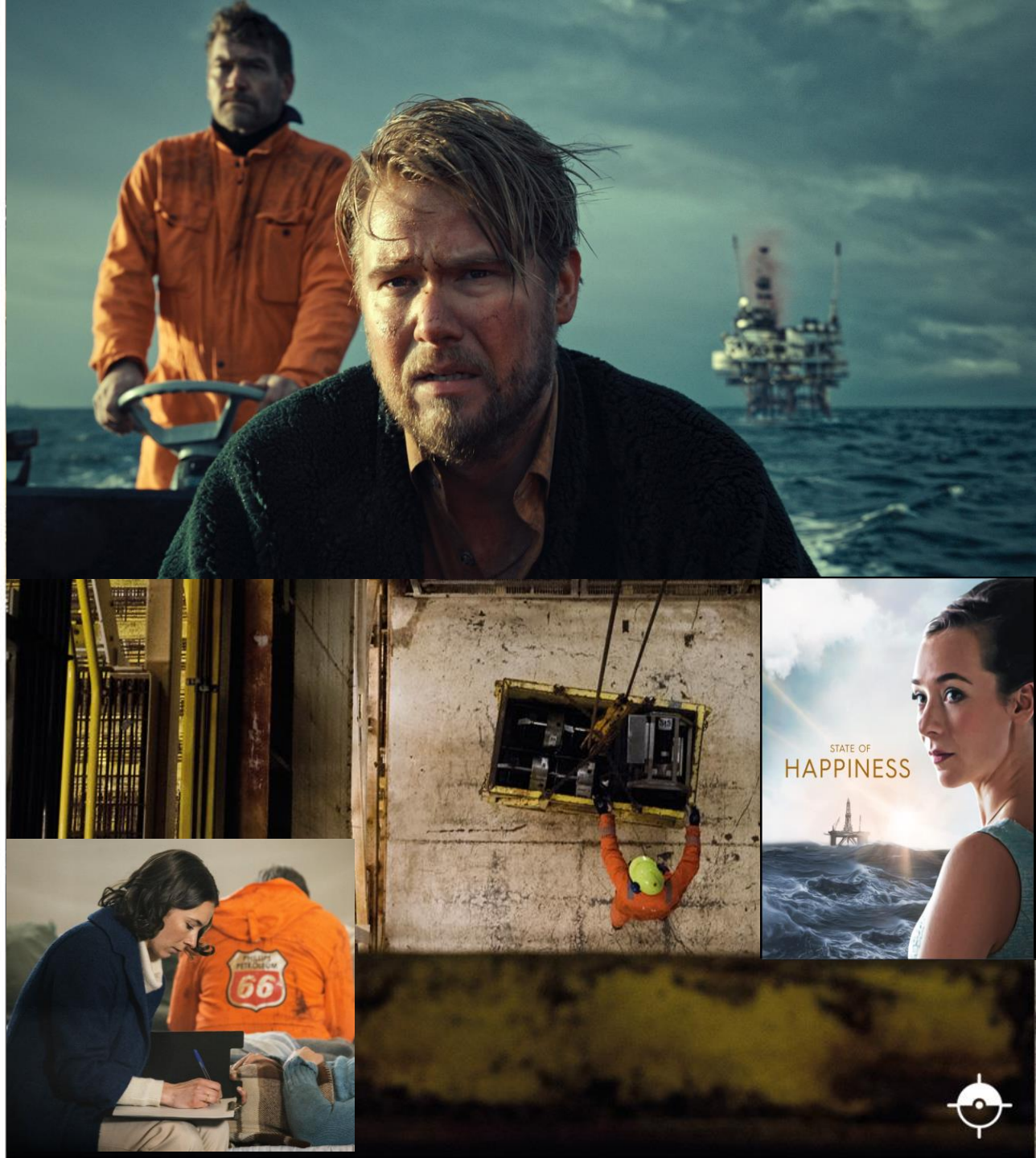
It is only through **continuous improvement** that we can improve and learn so that the Norwegian continental shelf will continue to be a **world champion within HSE**.

Overall objectives for PSA Norway

"The PSA will set the terms for and supervise that participants in the **petroleum industry** are maintaining a *high level of* ***health, safety***, ***environmental protection*** *and* ***emergency preparedness***,

and thereby also help to create the **greatest possible value for society**."

from "Our Crown Prince's Regent's resolution "

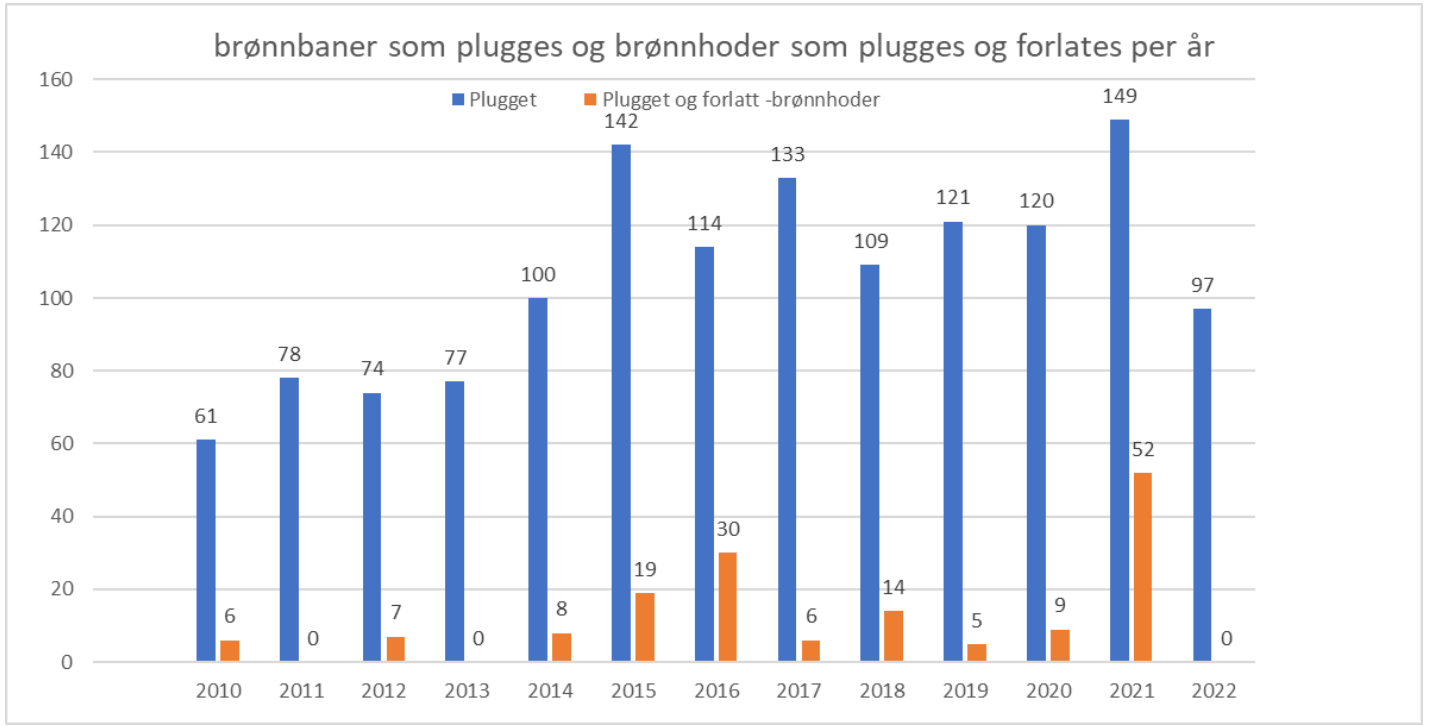


Statistics:

Number of permanent P&A of wellbores / slot recoveries from NPD

Orange: Permanent plugged wells
Blue: Slot recoveries

Number of wells re-used for slot recoveries and permanent abandoned wellbores



Statistics from NPD

Facility Regulations § 9

Qualification of new technology and new materials

Where the petroleum activities entail use of new technology (products, materials, tools) or new methods, **criteria shall be drawn up for**

Development, Testing and Use, so that the requirements for HSE are fulfilled; includes investigation and obtaining objective proof that the needs for a specific intended use are covered, cf. Section 21 of the Management Regulations.

The criteria shall be representative for the relevant conditions of use, and the technology or methods shall be adapted to already accepted solutions *(best practice)*

Guidance Level: DNVGL RP-A203 and Oil & Gas UK Guidelines on Qualification of Materials for the Abandonment of Wells, issue 2 can be used to fulfil the requirements regarding methods for the qualification of new technology.

TRL-process API 17N

New Technology

NORSOK D-010 Well Barrier EAC Table

No. 61 Perf, Wash and Cement Plug (PWC)

Table C.61 — EAC Table 61 – Perforate/wash/cement (PWC) cement plug

Features	Acceptance criteria	See
A. Description	This element consists of cement placed in the single annulus between the casing/liner and the borehole wall while also forming a cement plug inside the wellbore by using the Perforate, Wash & Cement technique (PWC). Note: this EAC table does not apply to dual casing PWC operations.	
B. Function	The purpose of the element is to provide a continuous, permanent seal across a perforated interval in the casing annulus and inside a wellbore, to prevent flow of formation fluids between formation zones and/or to surface/seabed.	
C. Design, construction, and selection	1) A programme shall be issued for each PWC operation, covering the following as a minimum: a) foundation requirements in casing and annulus; b) perforation hole size and density, relative to casing/hole sizes; c) parameters for washing perforations, and placement of spacer and cement; d) properties of mud and spacer, relative to formation and cement slurry design. 2) The cement plug shall a) be designed as per EAC Table 24 paragraph C; b) cover the perforations and the logged/verified interval in the annulus; c) extend 50m MD above the top perforation. 3) Planned perforation interval length shall be sufficient to obtain, as a minimum, 30m MD of cement bonding, verified by logging, for the element to act as a single barrier	
D. Initial verification	1) The annulus cement length shall be verified by one of the following: a) Bonding logs: Logging methods/tools shall be selected based on ability to provide data for verification of bonding. The measurements shall provide azimuthal/segmented data. The logs shall be verified by qualified personnel and documented. i) Actual cement length verified by bond logs shall be minimum 30m MD per barrier. b) If the element has previously been qualified for the same casing/borehole geometry, lithology, and fluid system, by drilling out cement and running cement bond logs, and a successful and auditable track record has been established, using a qualification matrix with a documented parameter set is considered sufficient for subsequent wells. i) In the event of losses, or the inability to perform the PWC operation according to the parameter set defined in the	DNV GL RP A203 [59]

- Builds on experience with emphasis on establishing a qualification matrix, track record and use industry best practice
  - Reference to establish track record in Norsok D-010 Rev 5/2021
- Emphasis on limitations of application

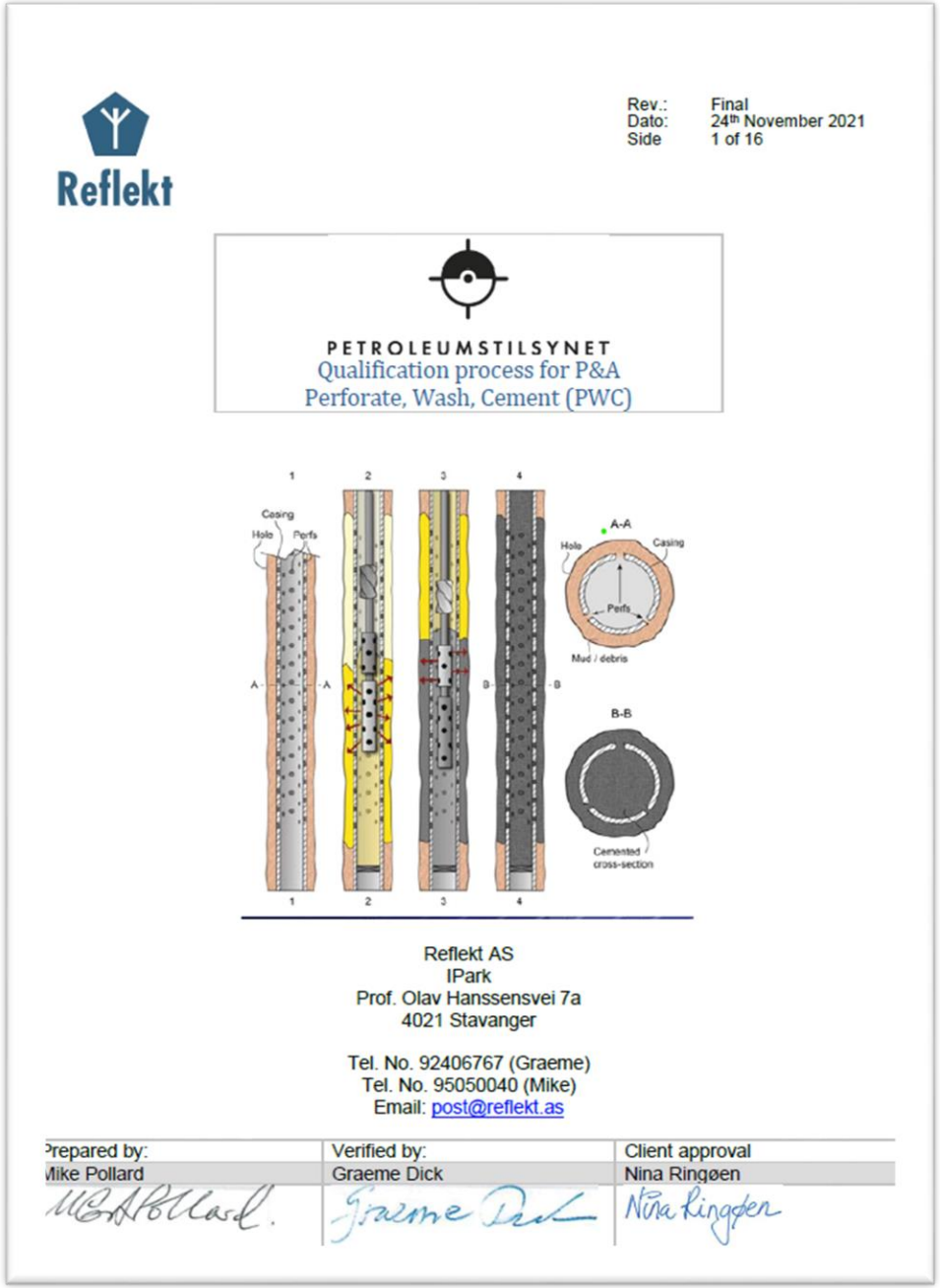
Section 5.2.4 Elements acceptance criteria (EAC) tables states:

- ❑ "*To qualify as a WBE, a well component shall conform to the acceptance criteria requirements specified in its corresponding EAC table. EACs shall be in place for all WBEs used.*"
- ❑ "*A new EAC table shall be developed in cases where an EAC table does not exist for a specific WBE. The level of detail shall be defined by the user*".

Qualification process for P&A "PWC report"

- Intention to Review of qualification processes and technology development related to Perforate, Wash and Cement (PWC)
- AkerBP, ConocoPhillips and Equinor have participated and provided information from their experience with qualifying and developing the method/technology
- The main technology providers in Norway, Archer and Hydrawell also contributed with their insight

Link: [Technology and methods for permanent plugging on the NCS (ptil.no)]



Reflekt

Rev.: Final
Dato: 24th November 2021
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PETROLEUMSTILSYNET
Qualification process for P&A
Perforate, Wash, Cement (PWC)

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Ongoing hearing on new EU Regulation on Methane Emissions

DRAFT

Proposal for a regulation on methane emissions reduction in the energy sector and amending Regulation (EU) 2019/942

Regjeringen.no

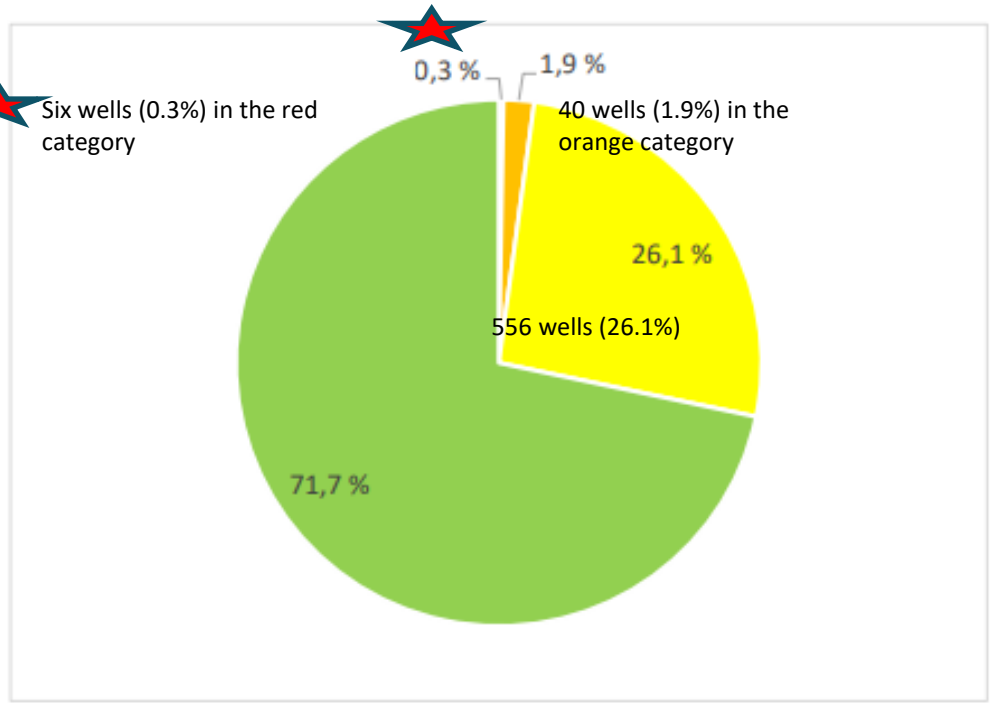
Co-ordinated feedback from Norwegian Authorities to OED.
PSA, NEA and NPD work closely together.

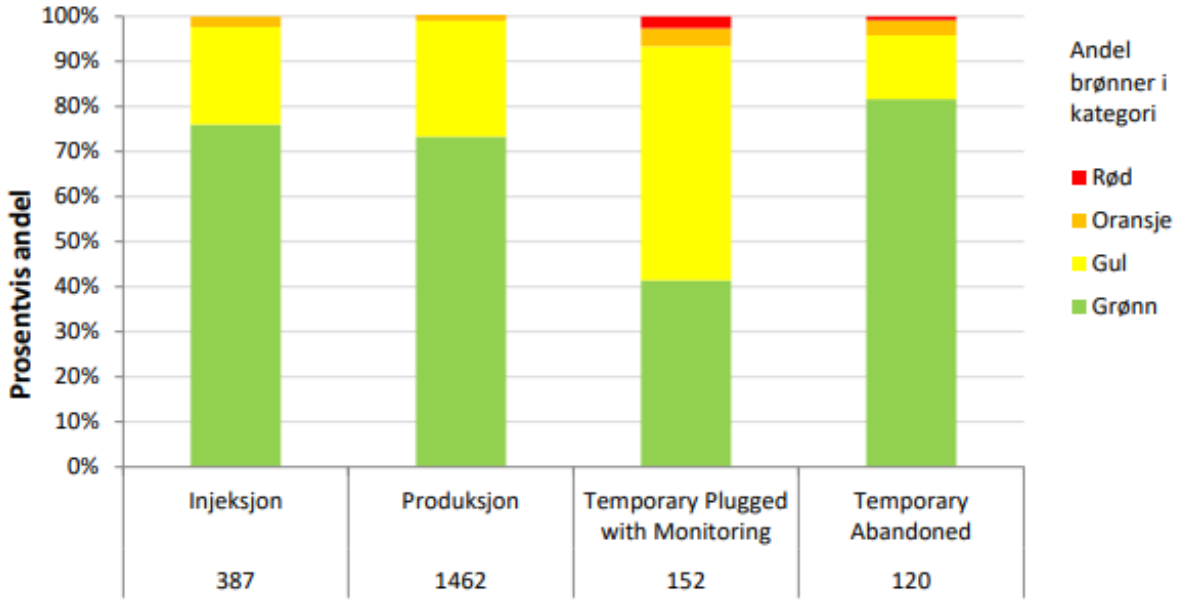
- Regular Meetings with Offshore Norge (Climate and Energy department)
- **Rev. 3 «Inactive well»** means an oil or gas well or well site, onshore or offshore, where operations for exploration or production have ceased for at least one year. It does not include temporarily plugged wells, permanently plugged and abandoned wells, as defined in this Regulation.
- **Temporary plugged** and abandoned wells
- **Permanent plugged** and abandoned wells
  - Will no be re-entered again.

EU Strategy is to improve measurement and reporting of methane emissions.

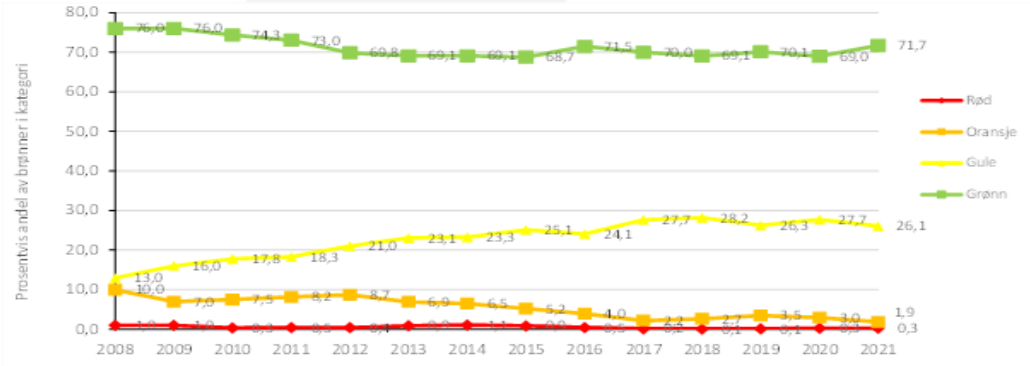
"Where [two] consecutive measurements quantification and pressure monitoring of methane emissions from an offshore temporarily plugged well, every two years, prove no methane emissions, this paragraph 2 shall cease to apply to that well".

Well Integrity status 2021
Total number: 2129 wells

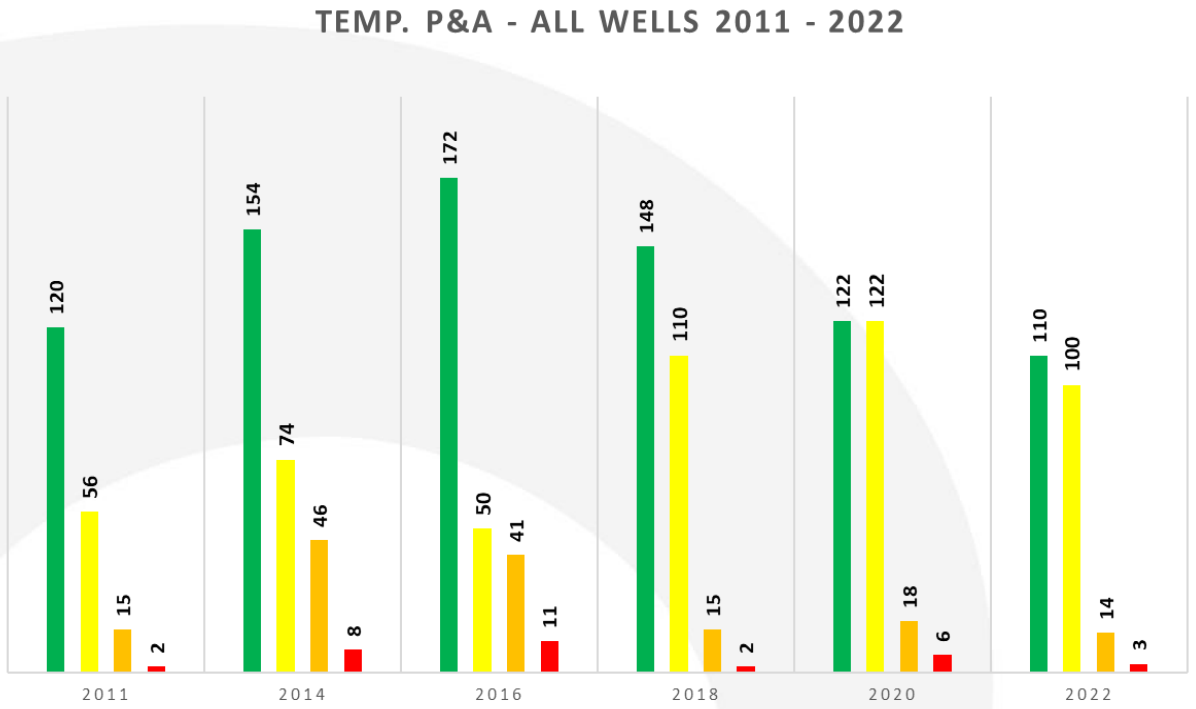




Figur 6-22 Brønnkategorisering - fordelt på brønnstatus, 2021[18]



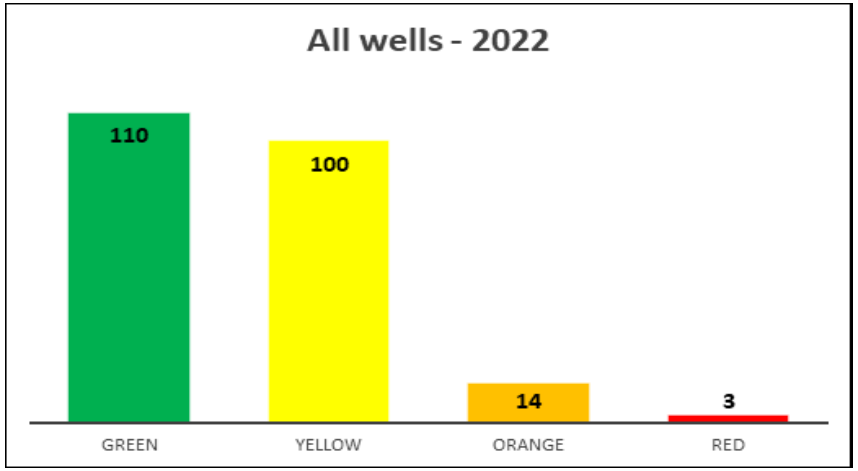
2022 Survey of Temporary Plugged and abandoned wells (Bi-yearly survey)



Year	Green	Yellow	Orange	Red	All
2022	110	100	14	3	227
2020	122	122	18	6	268
2018	148	110	15	2	275
2016	172	50	41	11	274
2014	154	74	46	8	282
2011	120	56	15	2	193

Changes 2020 – 2022

- Total number of wells in 2022 is lower than the preceding years (227 compared to 268).
- The reduction of 41 wells compared to 2020 is mainly caused by permanently plugging & abandonment of wells.
- The number of orange and red wells are also positively reduced with 7 wells compared to 2020.



Definitions

Temporarily plugged and abandoned wells are classified as “with monitoring” or “without monitoring» » according to NORSOK D-010, 10.5.1 as follows;

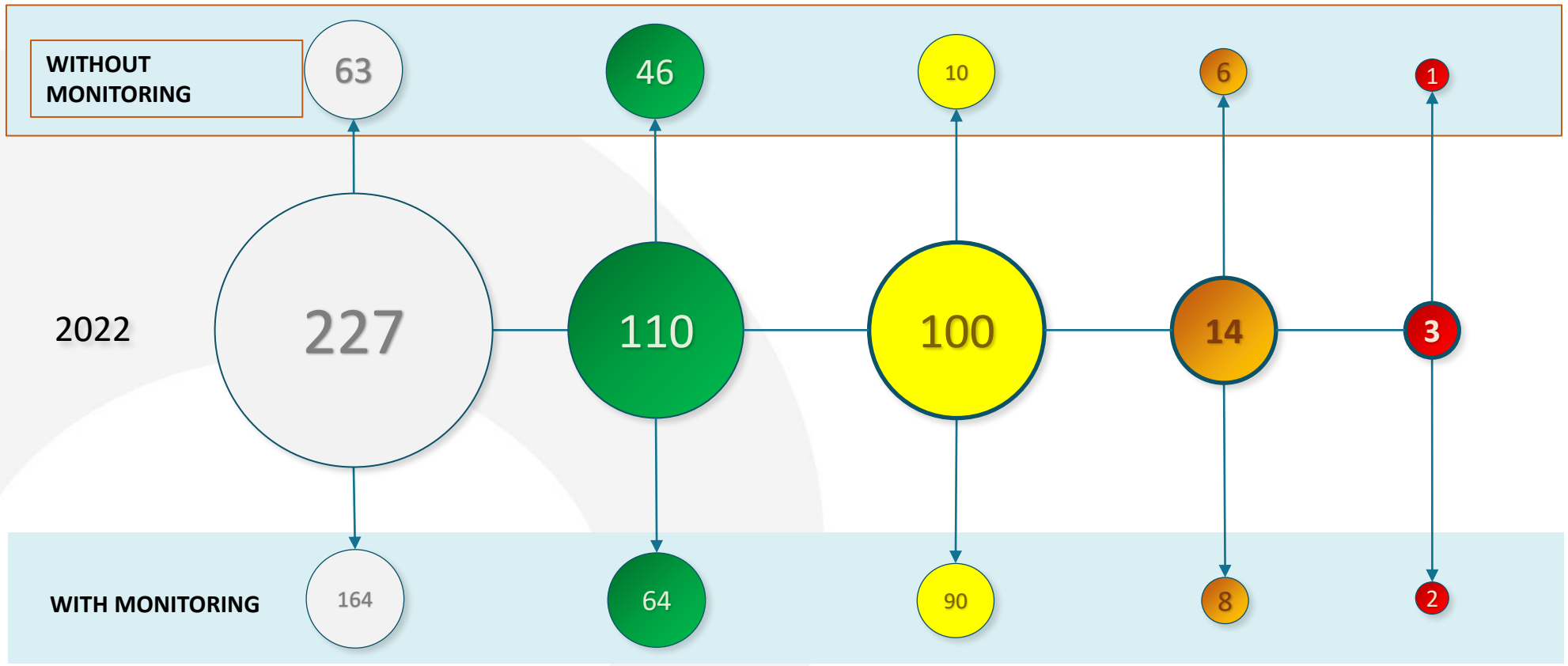
- *“**Temporary abandonment – with monitoring**; Well status where the well is abandoned, and the primary and secondary well barriers are continuously monitored and routinely tested.*

- *“**Temporary abandonment – without monitoring**; Well status where the well is temporary abandoned, and the primary and secondary well barriers are not continuously monitored and routinely tested.*

As per **Activity Regulations § 88, Securing of wells**, the duration of the temporarily plugging and abandonment period for wells without monitoring is maximum two (2) years for exploration wells, and maximum three (3) years for production wells.

Temporary plugged & abandoned wells 2022

Overview of temporary plugged & abandoned wells 2022 on NCS



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

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

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

Statistics – wells without monitoring

NCS Temporary abandoned wells 2022

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

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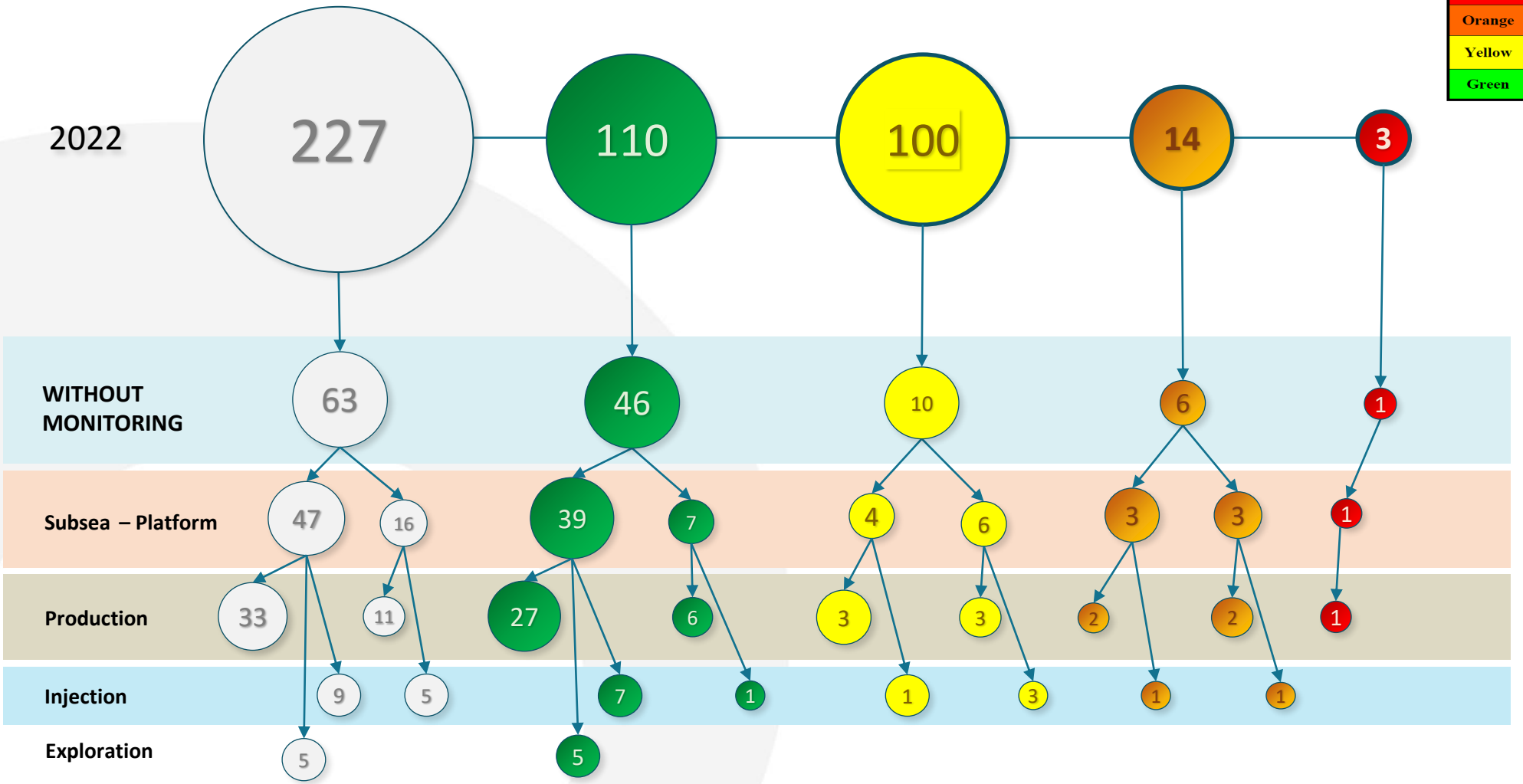
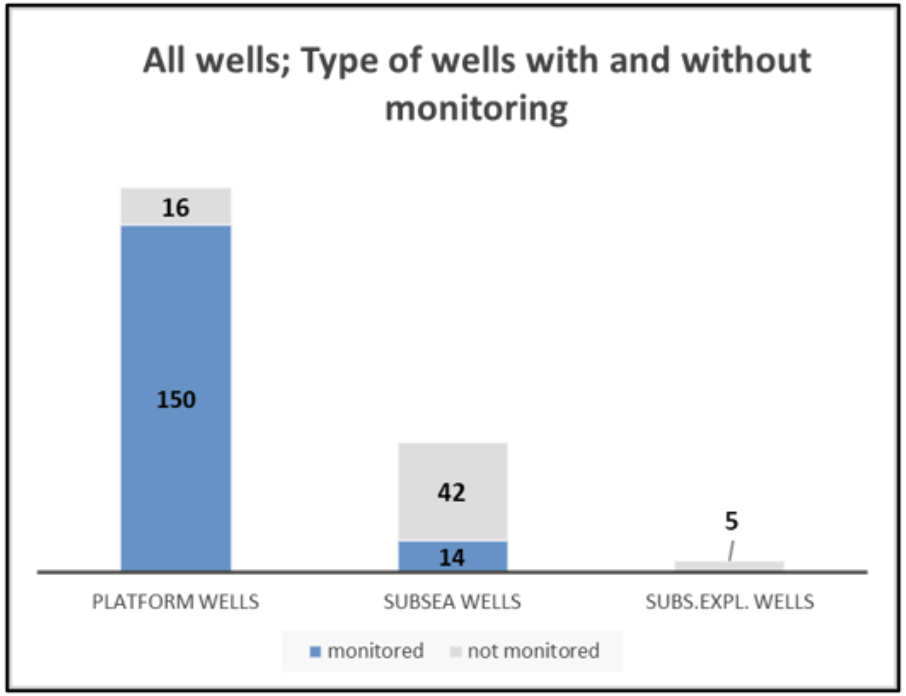
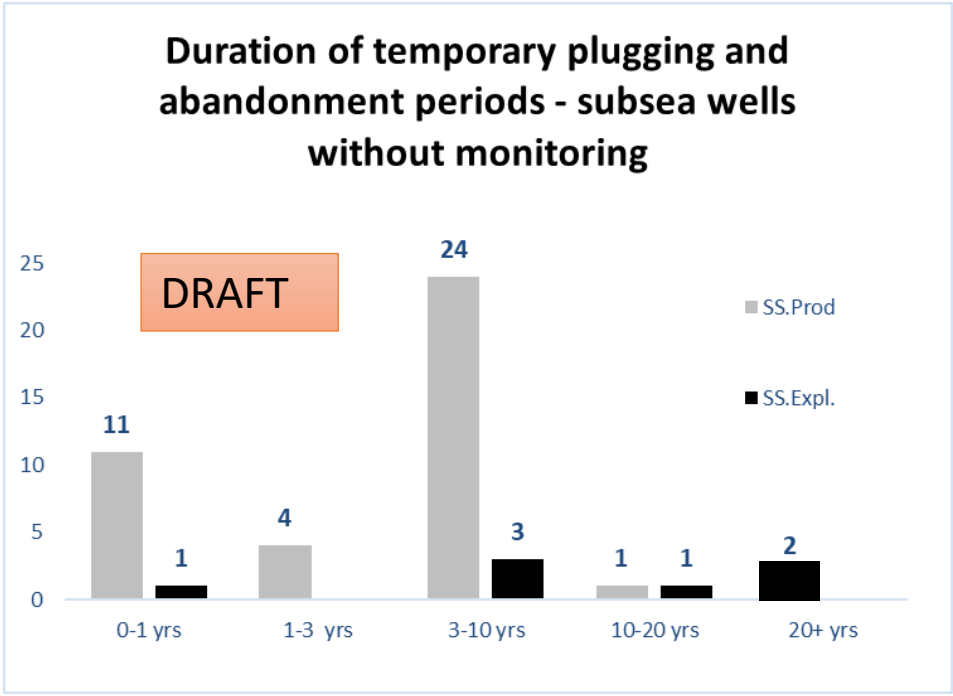


Temporary plugged wells





New Technology for more innovative P&A

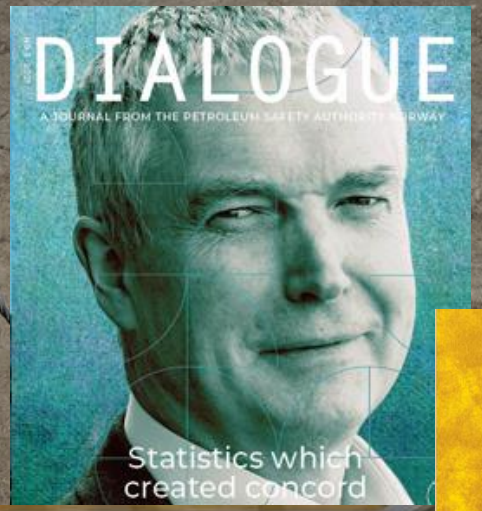
- **Equipment for monitoring of barriers (P/T) in Temporary plugged wells**

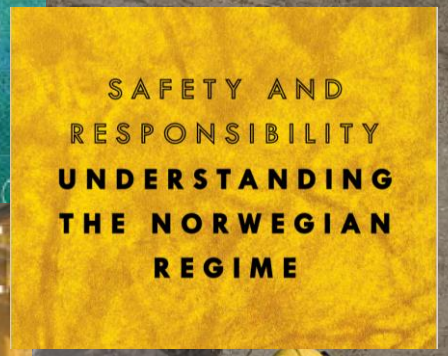
  "***what we can monitor, we can verify & influence***".....

  - A significant number of the temporary plugged and abandoned subsea wells falls into the category **"without monitoring"** (minimum requirement is yearly ROV survey or wireless monitoring to shore).

- **Our focus areas within plugging & abandonment;**
  - Sharing of learning and knowledge across the industry (and with PSA...)
  - Emphasis on the qualification process for new technology and new methods (TRL-process)
  - Focus on current risk level, regulatory requirements and potential for continuous improvement for **temporary plugged wells**

Questions?





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