

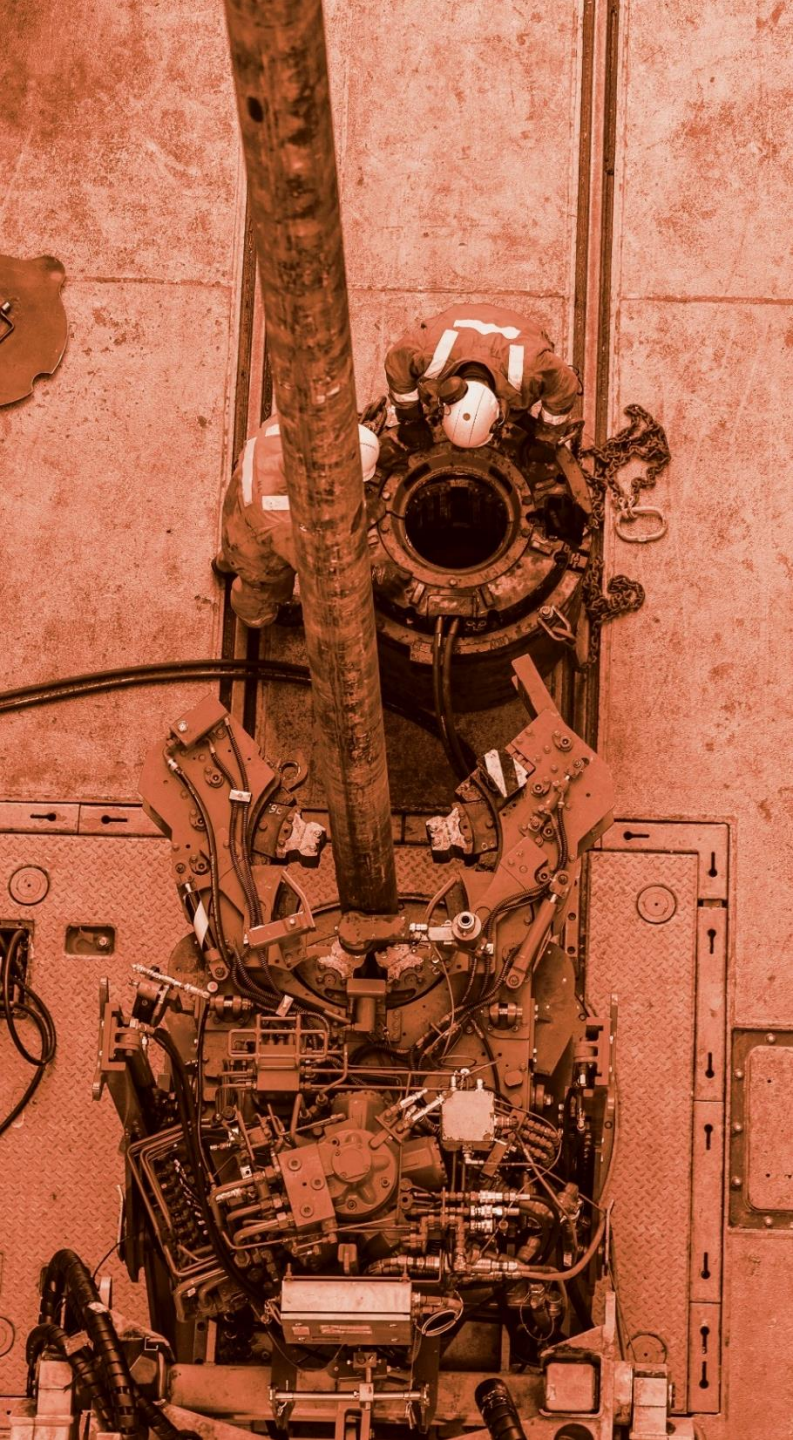


PETROLEUMSTILSYNET

Non- conventional Well barrier elements in P&A

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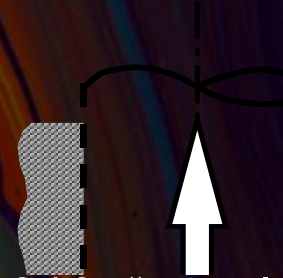


Background for the presentation

- PP&A of wells are challenging, time consuming and expensive
- Main challenges are establishing and documenting required well barriers
- Industry main focus today is to reduce cost and time
- The result is often non-conventional barrier thinking and challenging barrier verification:
 - existing and well proven verification methods are often unfit
 - new verification methods need to be developed and documented
 - more use of interpretations of subsurface properties
 - more use of risk assessment
 - higher uncertainty and higher acceptance level for risk?



What is a well barrier?



- NORSOK D-010: “envelope of one or several well barrier elements preventing fluids from flowing unintentionally from the formation into the wellbore, into another formation or to the external environment”
- Traditional well barrier elements in P&A: verified cement plugs and cemented casing/liner (cross-sectional barriers)
- Suggested “new well barrier elements”: swelling clays, Bismuth plug, thermite plug, interpretations of sub surface sand zones, dynamic flow models, “buffer zones”, “tight formation” with small potential of flow, “risk based evaluation of flow potential” etc



Requirements to well barriers

- **Regulations:**

- shall be designed such that unintended well influx and outflow to the external environment is **prevented** for the time in use and time subsequent to permanent plugging and abandonment so that well integrity is safeguarded during the time they are abandoned.
- Sufficient independence between barriers and specific, measurable and realistic **verifiable** requirements to performance such as reliability, integrity and robustness
 - Verification could be based on pressure testing, testing of accessibility, response time and leakage rates, as well as observation of physical properties.
- Risk assessment

- **NORSOK D-010:**

- Long term integrity (eternal)
- Impermeable
- Non-shrinking
- Withstand mechanical loads
- Resistant to chemical/substances
- Ensure bonding to steel



Challenges related to “new well barriers”

Establishment of necessary barrier elements in compliance with the regulations

Verification and documentation:

- “New barrier thinking” – little or no experience in the industry
- Lack of relevant well- and underground information?
- Quality and uncertainty of important underground parameters
- Long term quality of barriers/barrier materials (“eternal”)
- Existing industry standards “not fit” for new P&A solutions
- Uncertainty in input to and result of risk assessment
- Complex barrier philosophies



PSA's view on the way forward

- “New well barrier elements” are challenging both with regard to regulations and standards
- Wells should be P&A'd by using the requirements referred in the regulation
 - The premises are robust barriers and no leaking wells!
 - Cross sectional well barriers are still the requirement!
 - Verification and documentation of the well barriers are absolute requirements!
- P&A design/philosophy should be determined in the well design phase – higher focus earlier!
- **More** underground/well information to be collected during drilling, completion and production to reduce uncertainty in planning for P&A to increase the possibility for robust P&A
- The industry should develop, qualify and document necessary standards and requirements for “new well barriers” – industry responsibility!
- New verification philosophy needs to be developed, evaluated and accepted by the industry
- All relevant internal expertise should be used in planning the P&A – assure necessary inhouse competence



Thank You

Questions?

<http://www.psa.no>

