OIL & GAS

Risk-Based Abandonment of Offshore Wells
New DNV GL Guideline
PAF Seminar, Stavanger

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29 October 2015
Introducing New DNV GL Guideline

Today, DNV GL release a new Guideline

Risk-Based Abandonment of Offshore Wells

The document is available online at the following address:

dnvgl.com/pa-guideline

It is DNV GL’s intention that this guideline can be used as an alternative to current practices.
Some important principles in the regulations for the petroleum industry on the Norwegian continental shelf are presented here.

Risk-based regulations
Norway's regulations for petroleum operations offshore and on land are risk-based, and give great emphasis to principles for reducing health, safety and environmental (HSE) risk.

The aim is to minimise the threat of accidents, personal injuries, occupational illness and environmental damage. See section 11 of the framework regulations on risk reduction principles.

1- http://www.psa.no/regulatory-principles/category932.html
Risk Assessment Framework for Qualifying Well Abandonment Design

- International well integrity standards use a risk-based approach:\(^2\)

"The process of managing well integrity by operating wells in compliance with operating limits for all well types that are defined based on exposure of risk to people, environment, assets and reputation."

2- ISO/TS 16530-2 Well integrity - Part 2: Well integrity for the operational phase
Risk-Based Method

Current P&A Regulations Internationally

- There are prescriptive requirements as to the number and size of plugs required.
- The requirements are the same for all types of wells.

Paradigm shift

- The industry is looking to differentiate between P&A requirements on a well-by-well basis.

DNV GL Guideline

- The DNV GL guideline is a risk-based approach, where both the risk acceptance criteria is site-specific and the abandonment well design can be well-specific.
Are all P&A wells the same?

Moderate flow potential, hydrocarbon-bearing

HPHT reservoir, moderate flow potential

Limited flow potential, not hydrocarbon-bearing

Depleted reservoir, limited flow potential

Primary barrier
Secondary barrier
Surface barrier
System Perspective

- The system includes:
  - Marine environment
  - Geological formations
  - Well
So, what is the real concern?

The environment
Elements in well abandonment risk assessment

- Well Abandonment Design
- Well barrier failure modes
- Flow potential
- Valued Ecosystem Components
- Dispersion modelling
- Impact analysis
- Risk analysis
- Risk assessment
- Risk context
- Qualified well abandonment design

- Well specific input
- Geology input: Reservoir, Overburden
- Natural resources
- Metocean data
Elements in well abandonment risk assessment

Well Abandonment Design established

Well Abandonment Design

Well barrier failure modes

Flow potential

Valued Ecosystem Components

Dispersion modelling

Impact analysis

Risk analysis

Risk assessment

Risk context

Well specific input

Geology input Reservoir, Overburden

Natural resources

Metocean data

Qualified well abandonment design
Elements in well abandonment risk assessment

Identify failure modes for seepage pathways
Elements in well abandonment risk assessment

Potential seepage rate with probabilistic modelling

Probabilities in the order of $10^{-4}$
Elements in well abandonment risk assessment

Map Ecosystem and Valued Ecosystem Components (VEC)’s
Elements in well abandonment risk assessment

Dispersion of hydrocarbons in water and accumulation of hydrocarbons in sediment

Risk context

Well Abandonment Design

Well barrier failure modes

Flow potential

Valued Ecosystem Components

Dispersion modelling

Impact analysis

Risk evaluation

Risk assessment

Qualified well abandonment design

Risk context

Well specific input

Geology input
Reservoir, Overburden

Natural resources

Metocean data

Dispersion of hydrocarbons in water and accumulation of hydrocarbons in sediment

Fish and larvae
Coral and other benthic fauna
Seafloor sediment
Wellbore
Geological formations, overburden & reservoir

Not to scale
Elements in well abandonment risk assessment

Examine the overlap of the dispersion and accumulation vs. the environment
Elements in well abandonment risk assessment

Assess the risk vs. the acceptance criteria

No harm to the environment
Elements in well abandonment risk assessment

By using this method, the result is a qualified well abandonment design, measured up to the quality and standards of the Guideline.
P&A Well Barrier Requirements

- **NORSOK D-010:** A permanent well barrier should have the following characteristics:
  - a) provide long term integrity (eternal perspective);
  - b) impermeable;
  - c) non-shrinking;
  - d) able to withstand mechanical loads/impact;
  - e) resistant to chemicals/substances (H₂S, CO₂ and hydrocarbons);
  - f) ensure bonding to steel;
  - g) not harmful to the steel tubulars integrity.

- **DNV GL Guideline:** A permanent well barrier may consist of any material or combination of well barrier elements [WBE] as long as it provides the following functionalities:
  - withstand the maximum anticipated combined loads to which it can be subjected,
  - function as intended in the environments (pressures, temperature, fluids, mechanical stresses) that can be encountered throughout its entire life cycle, and
  - prevent unacceptable hydrocarbon flow to the external environment.
Advantages to using the risk based Guideline

Advantages to this approach are that it has:

- explicit criteria for environmental protection
- P&A spending focussed on higher-risk zones
- the ability to optimise P&A design
- flexibility to make use of new plugging technology in the future
- site specific considerations.
DNV GL Role – 3rd party well qualification – WellPAQ

DNV GL’s role is, based on the guideline, to be a 3rd party, where active verification is performed to qualify well abandonment designs.

DNV GL’s deliverable will be a DNV GL WellPAQ, a Well Plug & Abandonment statement of conformity.

The Statement of Conformity will be issued by DNV GL as a statement confirming that verification of documents and/or activities has concluded that the well abandonment design, complies with the recommendations in the guideline.

It is DNV GL’s intention that this guideline can be used as an alternative to current prescriptive practices and that the WellPAQ could provide evidence that regulatory requirements are met.
Today, DNV GL release a new Guideline

- **Risk-Based Abandonment of Offshore Wells**

It provides the framework for establishing and evaluating P&A wells individually using a risk perspective.

Considerable savings can be achieved using the risk-based methodology.

DNV GL can deliver qualification of well abandonment designs – **WellPAQ**.
End of presentation
Download Guideline at:
dnvgl.com/pa-guideline

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