Perforation Design for Novel P & A Method

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Efficiency

IKEA
Driving Factor
Section Milling
Perforate Wash Cement (PWC)
North Sea Experience

Case History Operational Times

- **Section Milling**: 10.5 days
- **Two Trip PWC**: 4.5 days
- **Single Trip PWC**: 3 days
Critical Design Factors
The Beginning of the End

Seafloor

Depth

Pressure

Single Gradient Density at TD

Fracture Pressure

Seawater Hydrostatic

Pore Pressure

TD
The Initial Approach
Engineered Approach

- Two deliverables
  - Diameter
  - Perforation Coefficient

- Four design Variables
  - Liner Material
  - Weight
  - Shape
  - Explosive

\[ \Delta P_{\text{PERF}} = \frac{MUD_{\text{PPG}} \cdot Q^2}{12035 \cdot A_{\text{PERF}}^2 \cdot C_d^2} \]
Design for the Future

Design Variables vs. Hole Size & Penetration

Penetration inches

Entrance Hole Diameter (mm)

Design

Entrance Hole Diameter (mm) Penetration

34 P3 34 P3 22 P1 22 P1 30 P3 22 P2 22 P1
Optimizing the System Performance

- Pressure
- Velocity
- Flow Rate
- Geometry

Source: Msc Dissertation Charles Nnaemeka Ukwuegbu, RGU University, Aberdeen
Designing Out NPT
Al-Qahira


Source: epmag.com
Simple Formula for Calculating Strength Degradation of Well Casings and Pipelines Due to Corrosion Pitting

New Pipe Formula

\[ P_b = 0.875 \times 2\sigma_y \left( \frac{t}{d_o} \right) \]

13 3/8 98 ppf N80 casing

\[ P_b = \frac{7,505}{2.67} \]

\[ P_b = 2,810 \text{ psi.} \]

2 > SCF < 3

- Source SPE 88572 by Kai Sun and Guo Boyun
Optimizing the System

Sources: nmi.com,
Minimizing the Pressure Effects

Wellbore Pressure vs. Time

- Designed Charge
- Initial Charge
What challenges do you have for the Perforate, Wash, Cement System?

Ikea
Charge Design
Low Actuating Pressure