

Abandonment in Greater Ekofisk. History & Challenges

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Agenda:

1. History of Abandonment in COPSAS
2. Strategic choices - time value of money & well life cycles
 - Well designs
 - Unit(s)
 - Personnel
 - Investment in Technology
3. Improvements in safety
 - Reducing platform risk
 - Well Control
 - Work Environment
 - Norsok compliance
4. The next 40 years.....
5. Questions?

History of Abandonment in Gr Ekofisk:

Original premise for fields and wells were +/- 20year lifetime. Abandonment was “far” in the future. Field lifetimes have been stretched and production sustained through water flooding projects.

Due to subsidence and age of infrastructure (*and low oil prices/high cost to upgrade older rigs*) many platform rigs were removed by 1998:-

2/4	Ekofisk Alpha, Bravo, Charlie, Delta, Tor
2/7	Edda, Eldfisk Alpha
7/11 A	Cod
1/6 A	Albuskjell Alpha
2/4 F	Albuskjell Fox

Planning for abandonment started in 1997

Modular Rig (Rig 66) was constructed as a P&A rig in Edmonton/Canada 1997 designed in 20mT modules to be used for P&A at all platforms. Smedvig was main contractor, Dresco was subcontractor.

As back-up rig to Rig 66, the Dolsnub-4 snubbing unit was provided from Dolphin (subcontracted from Smedvig).

History of Abandonment in Gr Ekofisk:

As a result of rig choices, the P&A team had to look for alternative P&A methods and started several studies for rig(less) solutions, plugging compounds, P&A technologies...

To save time, the wells on Cod were P&A'd with the snubbing unit Dolsnub 4 Oct 1998 - Aug 1999.

Rigless P&A technologies were developed, but time constraints prevented the best in class rig solutions to be selected, consequently the old workover rig (used on Edda, Kilo & Brent Delta) was selected, but required upgrade - new name became Rig 2000.

Rig 2000 was modified in Teesside 1999-2000 & ready for P&A starting on Albuskjell 2/4 F in June 2000.

All wells on the following platforms were then plugged as follows:

Albuskjell 2/4 F	June 2000 - July 2001
West 2/4 Delta	Dec 2000 - Dec 2002
Edda 2/7 C	June 2002 - Sept 2003
Albuskjell 1/6 A	Mar 2003 - Feb 2005

A number of wells needed to be re-entered.

This changed how abandonments were conducted

Strategic Choices (General):



Construction



S.R./P&A

Well & Platform Life cycle

Mature fields - design the well with contingency and flexibility

Assume that the bottom will need to be P&A'd more than once.....

Design for 2 Miocene plugs

Combine platform safety choices with P&A scope. Utilise the existing resources in the field

Eg - why suspend a reservoir section when you can P&A?

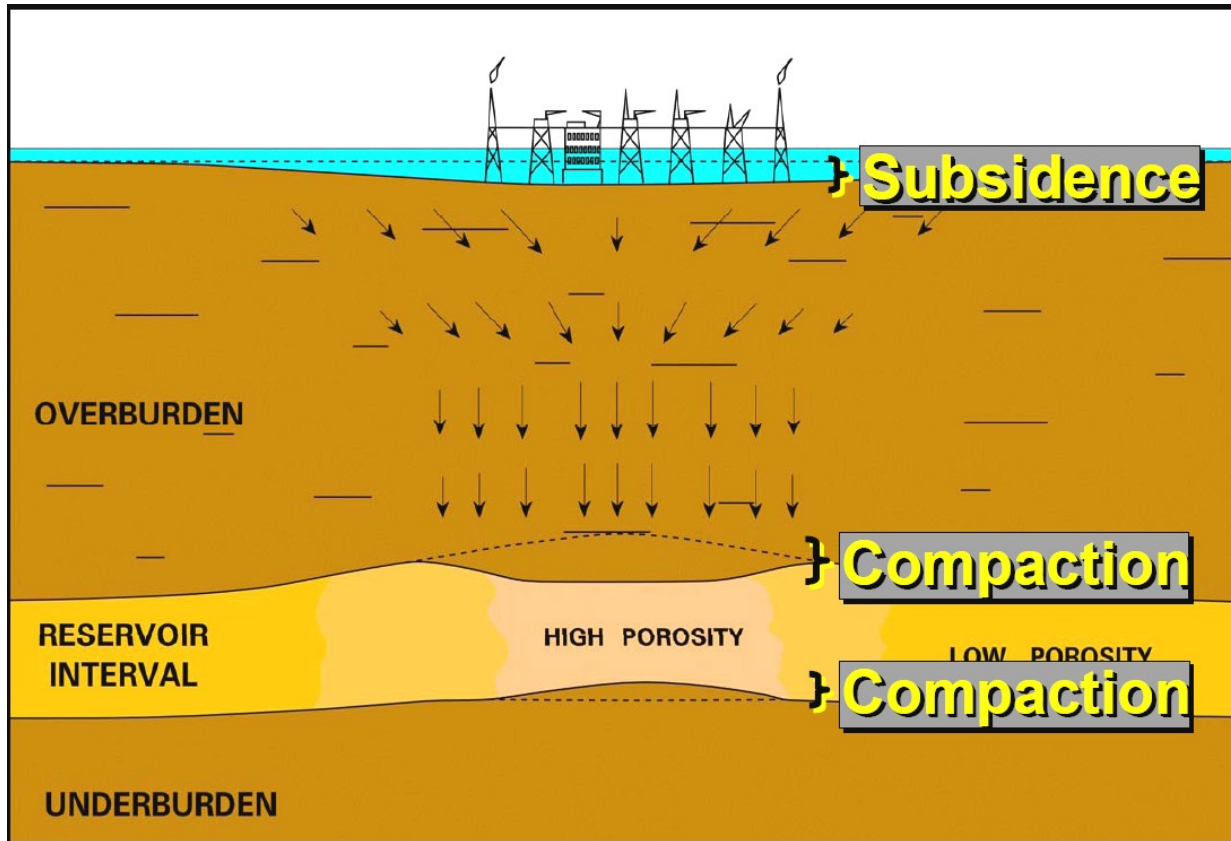
Sell it - "I can spend X now rather than 24X later"

Manage final abandonment as a "project"

- specialist resources
- **identify constraints + needed technology**
- contracting strategies
- risk assessment

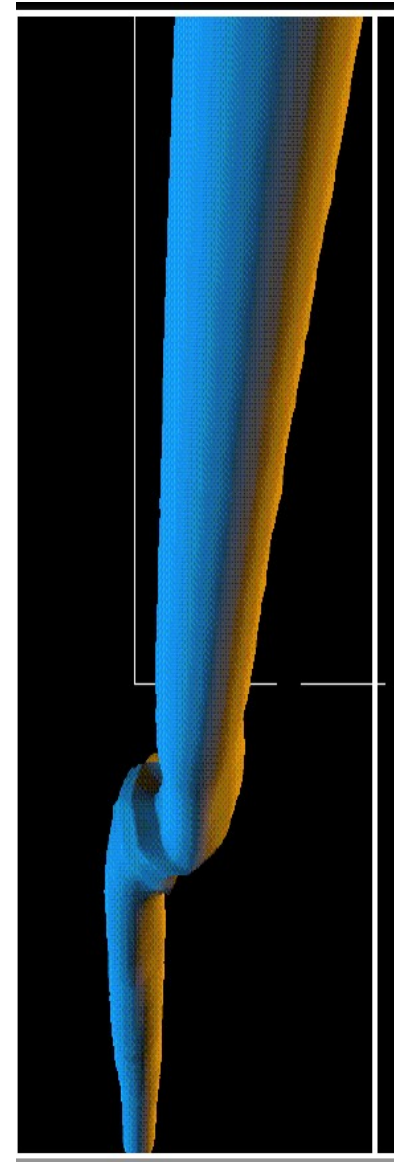
Use the slot recovery phase for trials.

Strategic Choices (Ekofisk Specific):



History and Future of the field - water flood or blowdown?

Changing pressure profiles and formation strengths.



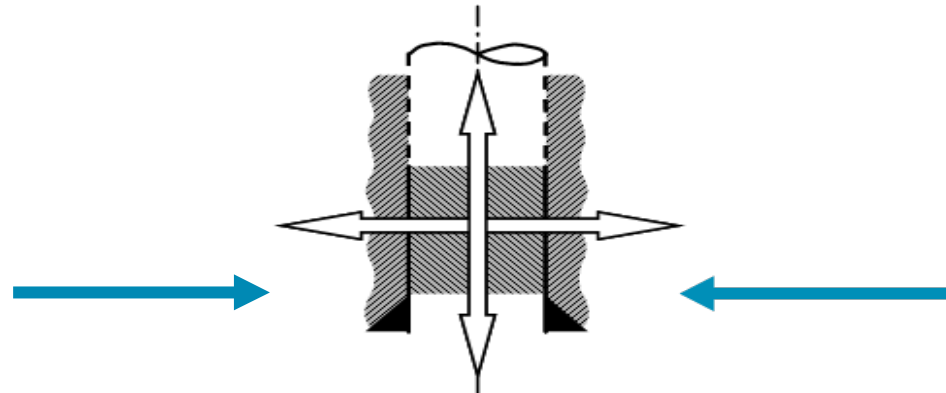
*Abandoning correctly
- preventing cross flow, releases to environment and not breaking the Petroleum fund*

Plugging & Abandonment NORSOK D-010 Section 9

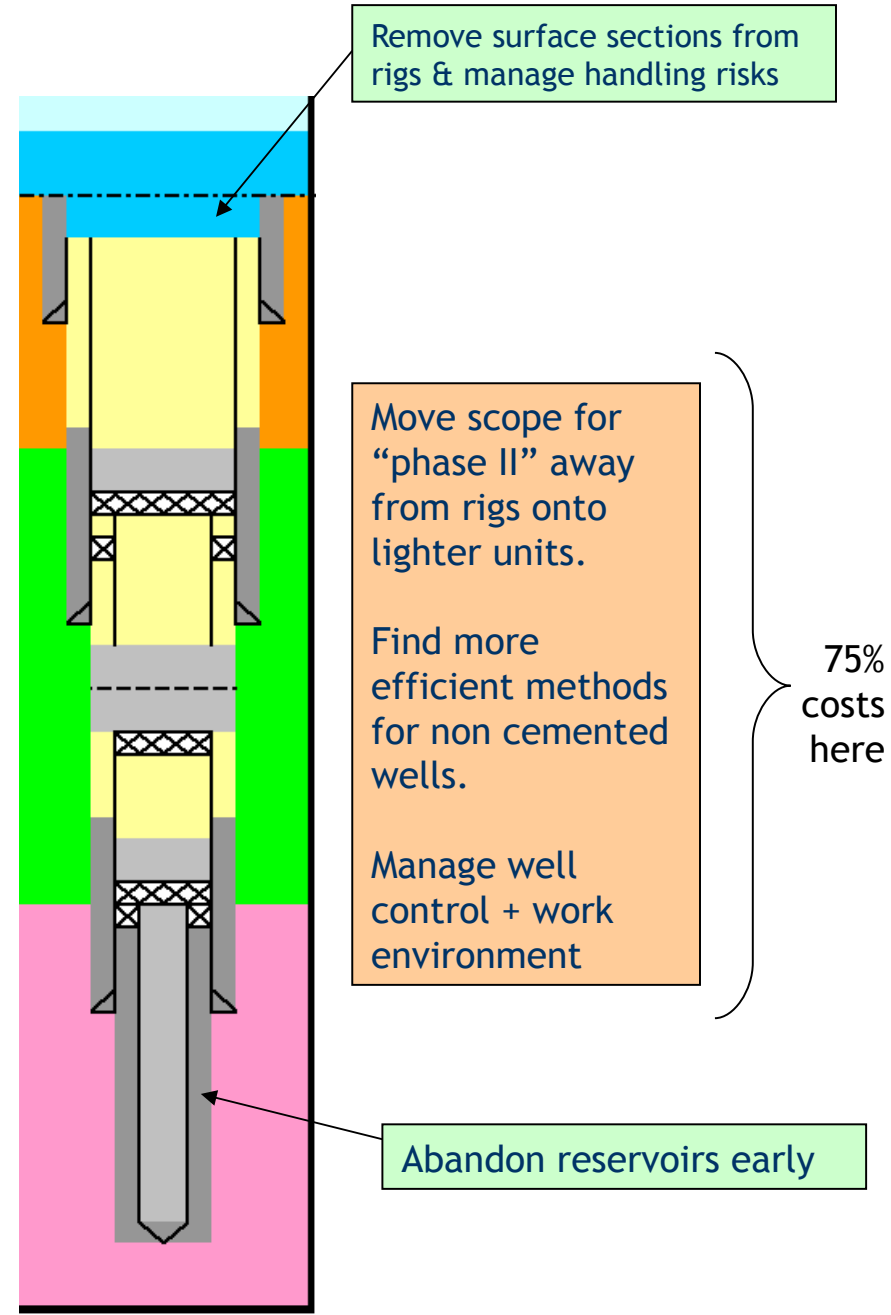
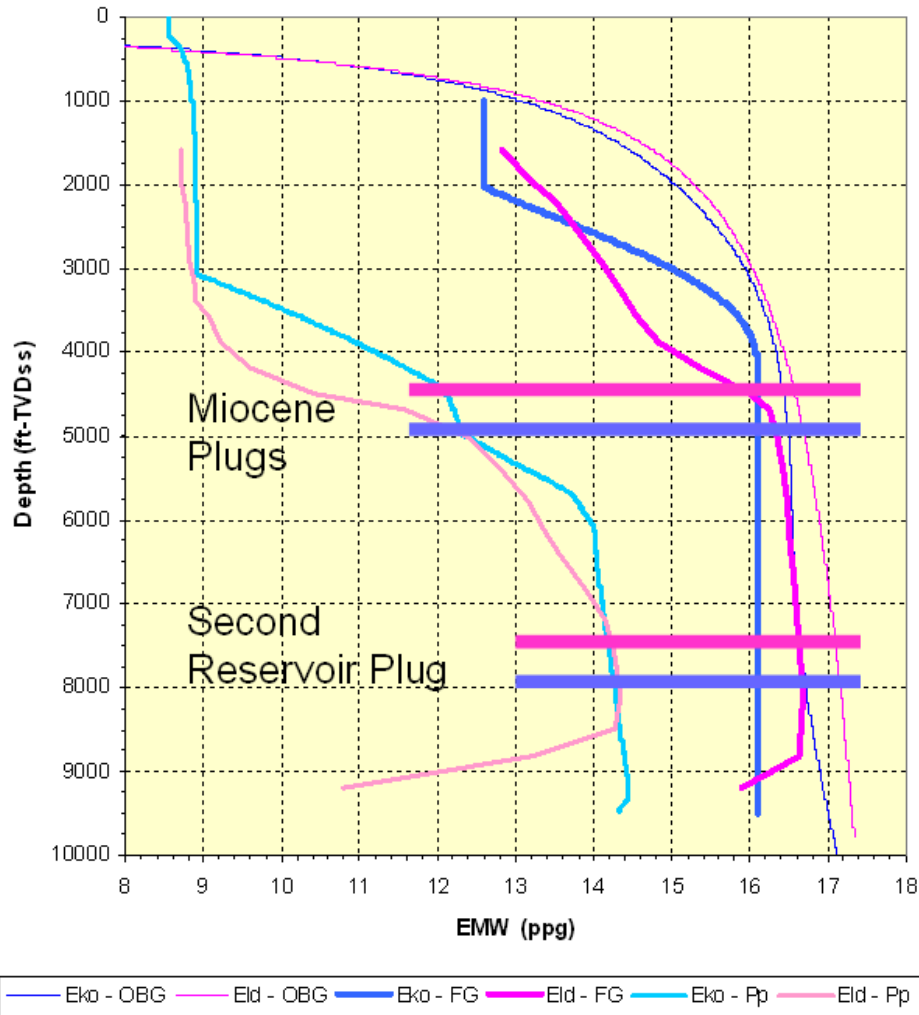
- Permanent well barriers **shall** extend across **the full cross section of the well**, include all annuli and seal both vertically and horizontally.

Primary & Secondary well barriers **shall** be positioned at a depth with sufficient formation strength at the **base of the plug** in excess of the potential internal pressure (worst anticipated reservoir pressure into account for the abandonment period).

The presence and pressure integrity of casing cement shall be verified to assess the along hole pressure integrity of this WBE.



What we are currently doing:-



Understand FSG's & pressures through lifetime

Technologies (Cessation Technology Focus):-

Understanding what you have:-

- Carbon Rod Technology
- Sonic Visualization
- Advanced Geomechanical models and fault mapping.
- Prediction of failure mechanisms

Minimising HSE risks:-

- Swarf – improved shakers (volume control) with less personnel exposure. Smaller chips to prevent pack-off's which trigger loss/gain events.
- Products that can isolate flowing annuli to allow safe nipping. (and that degrade?).
- Reduction of personnel on older platforms.
- Handling well fluids + reduction of waste

Reducing time and cost (barrier across wellbore):-

- Section Milling (Cutter Improvements)
- Conventional Casing Milling (Optimizations)
- Perforate, Wash and Cement Behind Casing
- Upward Milling
- Multi-cut, Circulate and Pull Systems
- Jacking Systems (Downhole)
- Operations through nested 7" x 9-5/8" Casing
- Rotary Expansion
- Barrier Repair Systems
- Rigless Abandonment (Coil / Uphole Jacking)

The next 40years:-

Will we still rely on cement to isolate wells?

Will a log ever tell us if the cement will hold?

Will we ever be able to be truly “rigless” for P&A?

Are we losing reserves because of old decisions?

Will Authorities change the regulations?

Will we blow-down more fields? Or inject CO₂?

What is the technology or strategy that we are missing?

Questions?