Offshore Managed Pressure Drilling Experiences in Asia Pacific

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Introduction

- Over 150 MPD wells drilled.
- Mainly in fractured limestone.
- Offshore and Onshore.
- Closed well bore system.
- Most wells successfully drilled.
- 14% of wells with Downhole valve in combination with MPD.
Why Managed Pressure Drilling?

• Fractured Limestones 94% of Wells
  – Total or Severe Losses / kicks
• Fractured Basement 4% of Wells
  – Inflow / Connection gas
• High Pressure High Temperature 2% of Wells
  – Wellbore Ballooning
  – Early Kick Detection

• Main application of MPD in Asia Pacific fractured carbonates, Baturaja or Kujung formations.
• Narrow margin HPHT wells increasing.
Why not Underbalanced ??

- Large Inflow
- No liquid / cuttings returns
- Handling of Hydrocarbons
- Crew size
- Equipment size
MPD Techniques

1. **HSE or Returns Flow Control (RFC)**
   - Diverts flow away from rig floor, avoids closing the BOP
   - Allows pipe movement whilst killing the well

2. **Constant Bottom Hole Pressure (CBHP)**
   - Surface pressure applied to maintain bottom hole pressure
   - Well closed in on connections ECD compensated

3. **Dual Gradient (DG)**
   - Two fluid gradients used to control the well
   - mainly associated with deepwater

4. **Pressurized Mud Cap Drilling (PMCD)**
   - Sacrificial fluid used to drill
   - Cap fluid to maintain well control
Preparing for MPD

- Installation of RCD, space requirements between BOP and rotary table.
- RCD Connections.
- Location and connections for the RCD power unit & control unit
- Return flow line for MPD and conventional drilling
- Annular injection requirements for PMCD operations
- Location and configuration of choke manifold, if required
- Location and set up of the two-phase separator, if required
- logging, casing and cementing operations
- Marine riser issues for Riser Cap operations
- Drillpipe sizes that are to be used
- Pressure bleed-off lines
- Utility tie-in points for the equipment, power and air
- Rig-specific requirements
Conventional Drilling
Managed Pressure Drilling

Using 5-1/8 in ID valve and 90 ft x 5-1/2 in ID hose
Calculations using Bingham fluids model
Returns Flow Control
Pressurized Mud Cap

To bleed off line
To trip tank
Main flow line
Annular fluid injection line
Kill line
Choke line
Constant Bottom Hole Pressure
Constant Bottom Hole Pressure
Riser Cap

To bleed off line
Annular fluid injection line (secondary)

Main flow line
Annular fluid injection line
Docking Stations
Surface BOP’s

• Fixed Installations surface BOP
  – Use pony subs under the rig and raise the rig to make space.
  – Do not remove Ram or annular BOP’s to make space for the RCD
  – BOP stack must still function as the secondary well control system.
  – Ensure rig is alignment to ensure RCD rubber life (0.5 inch).
  – Flow lines to the BOP stack must allow operations from the rig floor
  – Flow line routings must be reviewed and agreed during the design process.
  – Pressure testing of the MPD equipment must be agreed before starting.
  – RCD elements cannot be tested against a closed annular BOP or ram
  – Logging requirements must be prepared in advance.
  – Testing of logging / snubbing adaptors need to be agreed with all parties
  – Casing running and cementing operations can all be conducted with the RCD in place.
  – ID and OD measurements must be known when using unitized wellheads and hangers.
Floating Installations

- Floating Installations
  - Heave does not have a significant impact on the life of RCD rubbers.
  - Rig offset must be monitored.
  - Installation procedures for the Riser Cap equipment must be reviewed during well planning stages with contractor and operator.
  - Installing the spool and RCD together saves rig up time.
  - Hoses are connected only once equipment is installed on the riser.
  - Safety procedures for working on the riser need to be implemented.
  - Drillpipe condition has a significant impact on rubber life.
Conclusions

- Know what kind of MPD is required for the well
- Gate valves cannot be opened with pressure.
- Rig alignment and drillpipe condition are all important for RCD rubber life
- Plugging of the 6 in return line and valves is not an issue
- Rig modifications for most MPD operations are minimal
- MPD operations have been conducted on all types of rigs with minimal down time caused by MPD equipment.

**MANAGED PRESSURE DRILLING**

**MAKES PROBLEMS DISAPPEAR**