Rigless Well Stimulation using an MSV – Case study

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Subsea wells can encounter permeability inhibitive sediments which reduce or stop the flow of production.

Well stimulation is a type of well intervention used to pump diluted acid mixtures into the well.

Chemicals dissolve offending materials and restores the natural permeability of the formation.

The acid solution is pumped above well bore pressure but below well fracturing pressure.

Injected chemicals dissolve the restricting material and production restored.

Courtesy of: MPG Petroleum
Traditional Well Stimulation Overview

- Mobile Offshore Drilling Unit or LWI.
- Riser based pumping system.
- BOP for well control.
- Topside storage/supply of chemicals.
- Injection of acids (HCl, HF, etc) to dissolve permeability inhibitive sediments.
- Increases permeability of reservoir and stimulates production.
Case Study Overview

- Gradual productivity decline from some deepwater wells.
- Significant reduction in flowing bottom hole pressure.
- Aggressive pressure maintenance programs (water/gas injection) proved unsuccessful.
- Well not achieving desired performance results.
- Acid stimulation of the well to treat impaired wells identified as suitable option.

Courtesy of Tullow Oil
Case Study Challenges

• Operating costs for rigs.
• Availability of Light Well Intervention Vessels.
• There was a high demand on rigs.
• Lengthy mobilisation/demobilisation periods.
• Extended operating timeline with rigs
• Economic analysis to justify stimulation.
Remote Alternative Challenges

- Eliminate a rig/LWI and perform same tasks from a MSV.
- Delivery of fluids from a MSV.
- On deck chemical storage and pumping.
- Loss of DP or vessel drive off risk management.
- Well control capability without a BOP.
- Well circulation/back flushing capability.
Remote Technology
Remote Technology

- Subsea Safety Package
  - Wellbore isolation
  - Acoustic ESD
  - Mechanical Breakaway
  - TRT controls
  - Accumulator pre-charge
- Open Water coil tubing reels or HP hose delivery.
- On deck chemical storage.
- Topside pumping and controls.
Single Vessel Remote Configuration

SPE Workshop - Mature Fields: Leveraging Experience for Future Value
Safety Strategy
Well Barriers and Well Control

• Well Barriers:
  – Well Stimulation Tool contains the primary well barrier valves.
  – These are tested on deck prior to deployment and subsea prior to commencement of pumping operations.
  – Tree PWV and PMV are considered auxiliary well isolation valves.

• Tree valves (PWV and PMV)
  – Controlled remotely on vessel for normal operations.
  – Closure triggered directly from MSV controls for EQD.

• Five levels of emergency shutdown (ESD) of system.

• Two primary means to initiate emergency disconnect and well shut-in.
Acoustics and Mechanical ESD

- **Acoustic Trigger ESD**
  - Utilised on the first well stimulation in 2007.
  - Acoustically triggered remote accumulators.
  - Dual bore isolation and emergency disconnect.
  - Stand alone/battery operated transponder
  - Operator required to activate.
  - Full ESD achieved in less than 7 seconds.

- **Mechanical Breakaway ESD**
  - Utilised on the most recent remote well stimulation campaigns.
  - Separates if an externally applied tension load exceeds a preset value.
  - Isolation and disconnect capability.
Project Results Summary

Initial Max Production

Production declined by approximately 20% in 1 year.

0CA/HCl treatment increased production by approximately 20%.

Riserless treatment increased production by an additional 20%. (more gains achievable).

Courtesy of: Tullow Oil
Project Results Summary

PRE & POST RIGLESS ACID PRODUCTIVITY INDEXES

Productivity Index (BPD/PSI)

Well 1  Well 2  Well 3  Well 4  Well 5

Initial Completion  Pre-Acid  Post Acid
Remote Method Vs. Traditional Method
(Base Asset Cost Comparison)

Cost in USD Based on Two Well Stimulation Campaign

- Semi Sub Rig (14 days)
- Rigless Intervention (9 days)
Other Europe Applications and Challenges

- Are reservoir complications prevalent across Europe?
- Regulatory compliance issues using an MSV?
- Rig availability Vs. vessel availability?
- Can we expect an increase in stimulation projects in this market?
- Deepwater Vs. shallow water applications?
- Acoustic Trigger ESD Vs. Mechanical ESD?
- Non-traditional method concerns?
- Is there a need for remote methods in Europe?
- Rig rates vs. vessel rates?
Thank You for Your attention!

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