Different Configurations of Intelligent Well Completions with Three Stacked Frac Packs

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PRESENTATION OUTLINE

- Introduction
- How Depletion Plan drives the Completion Design
- Review of IWS (Intelligent Well Systems)
- Completion Equipment Design Criteria
- IWS for 3 Gravel Packs – Lowest two are commingled
- IWS for 3 Gravel Packs – Upper two are commingled
- Conclusions
WELL #1

- Subsea completion in 2,640’ WD
- Multiple stacked pay zones from 13,000’ to 17,000’
- Lower zone: 200’ of pay with large shale break
  - Drive Mechanism: Partial water drive / pressure depletion
- Upper zone is 2,300’ TVD above Lower
- Pressure differential between zones (~ 2,300 psi)
WELL #1 PAY SANDS
WELL #1

- Middle Gravel Pack
- Pressure Operated Communication Device
- Lower Gravel Pack
- Pressure Operated Communication Device
- Concentric Tubing
WELL #2

- Subsea completion in WD = 2,640’
- Upper zone: 200’ of pay with large shale break
  - Drive Mechanism: Pressure depletion
- Lower zone marginal – Complete now or leave behind
WELL #2 LOG SECTION

- Subsea completion in 2,640’ WD

- Upper zone: 200’ of pay with large shale break
  - Drive Mechanism: Pressure depletion

- Lower zone marginal – Complete now or leave behind
DEPLETION PLAN

- Minimize development cost
- Accelerate the depletion of multiple reservoirs
- Production selectivity at minimal cost
  - Can an IWS (Intelligent Well System) meet these objectives?
INTRODUCTION TO IWS

- Splice Sub
- Feed Through Packer
- Triple Gauge Carrier
- Upper Remotely Operated Sleeve
- Lower Remotely Operated Sleeve

Flow from Upper Zone
Flow from Lower Zone
INTERFACE BETWEEN IWS AND UPPER GRAVEL PACK

Seal assembly from “IWS” locates into the upper GP concentric PBR

Upper Gravel Pack Screen with concentric assembly
Pressure Operated Communication Device: Enables annular flow behind the concentric tubing & PBR to provide flow path to the upper “intelligent” sleeve.
COMPLETION EQUIPMENT DESIGN CRITERIA

Blank

Screen

Lower Gravel Pack Packer

Pressure Operated Communication Device: Enables annular flow into the concentric tubing to provide flow path to the lower “intelligent” sleeve

Concentric Tubing

Sump Packer
WELL #1: IWS WITH 3 GRAVEL PACKS
(2 Lower Zones Commingled)
WELL #2: IWS WITH 3 GRAVEL PACKS
(2 Upper Zones Commingled)
WELL #2: IWS WITH 3 GRAVEL PACKS
(2 Upper Zones Commingled)
COMPLETION CHALLENGES IN SUBSEA ENVIRONMENT

- Managing zonal isolation between several reservoirs with unequal pressures during Completion operations
- Space out to land tubing seals of IWS in GP assembly while landing the tubing hanger in a subsea tree
- Control of debris in wellbore
- Interface between IWS and 3 gravel packs where the two upper zones are commingled
  - Gravel pack tools design to enable various flow paths for the IWS
CONCLUSIONS

- Conventional IWS (two valves) can manage 3 stacked gravel packs with proper completion equipment design and placement.
- IW technology can maximize production from 3 different gravel packs without a future well intervention.
- IWS for 3 gravel packs with upper two zones commingled:
  - Requires most complex completion design.
  - Has multiple completion design options to manage differential pressures between sands.
- An “Intelligent Completion”:
  - Maximizes NPV by reducing the development cost of a significant subsea field.
  - Can accelerate the depletion of multiple reservoirs.
  - Offers production selectivity at minimal cost.
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Questions?