Pigging needs for subsea production lines

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AGENDA

Why Pig subsea production flowlines ?
Illustration of single production line
* Pazflor Miocene development
Conclusions
Why pig subsea production flowlines?

- To keep the pipe wall clean of deposits or solids
  - To remove any restriction to flow
  - To improve the effectiveness of corrosion control by chemical treatment (corrosion inhibitor, biocide)

- To manage liquid accumulations
  - To keep liquid hold-up within manageable limits
  - To prevent for localized corrosion (stagnant water)

- To assess the pipeline condition with smart pigs
  - To detect metal loss / corrosion
  - To detect cracks

Subsea architecture and pigging

<table>
<thead>
<tr>
<th>PROS</th>
<th>CONS</th>
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<tbody>
<tr>
<td>DUAL FLOWLINE</td>
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<tr>
<td>LIMITED OPEX</td>
<td>CAPEX</td>
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<td>FIELD PROVEN</td>
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<tr>
<td>ROUTINE PIGGING FEASIBLE</td>
<td>SHORT FALLS (wells shutdown)</td>
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<td>REVERSE FLOW CAPABILITY</td>
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<td>SINGLE FLOWLINE</td>
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<tr>
<td>CAPEX REDUCTION</td>
<td>HIGH OPEX (Field Service Vessel)</td>
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<td>LESS EQUIPMENT ON TOPSIDES</td>
<td>SUBSEA PIG LAUNCHER</td>
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<td>LIMITED EXPERIENCE IN DEEPWATER</td>
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<td>OPERATIONAL RISKS</td>
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Case study Pazflor

MIOCENE FLOWLINES

• Carbon steel 10"
• Wall thickness: 11.2 mm (3 mm c.a.)
• Continuous inhibition with Corrosion Inhibitor
• In line Inspection planned to prove integrity

PAZFLOR MIOCENE SYSTEM

• Water depth: ~ 800 m
• Multiphase single line
• Subsea gas/liquid separator & boosting

Layout Pazflor Miocene

<table>
<thead>
<tr>
<th>Line</th>
<th>Length</th>
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<tbody>
<tr>
<td>P10</td>
<td>9 km</td>
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<tr>
<td>P20</td>
<td>10 km</td>
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<tr>
<td>P30</td>
<td>8 km</td>
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Subsea separation & boosting unit

- Flowline operated at low pressure for efficient well’s lift
- Liquid pumped at high pressure
- Diameter 10” for flowline and liquid riser
- By-pass valve: closed in production mode
- Pigs to be run from FLET to Topsides

Subsea pigging operation main facts

- Operation planned
  - Cleaning of the flowline
  - In line inspection with smart pig

- Main requirements:
  - Pigging Subsea to FPSO
  - No Hydrocarbon return on FSV
  - Bi-directionality (reverse flow)
  - Pig propelled using treated seawater
  - Operations in Shutdown conditions

Complex, risky & costly operation
Equipment required for the operation

- **Subsea Pig Launcher and tie-in to FLET**
  - Mudmat module ~ 40 T
  - Pig launcher ~ 8 T
  - Flexible jumper 100 m ~ 50 T

- **Downline equipment**
  - 4” x 1000 m flexible
  - Emergency Quick Disconnect system
  - Tensioner + Reel frame - 40 + 68 T
  - Aids - Sheave + Clamp + DMA

- **FSV equipment**
  - Nitrogen skid
  - Pumps (seawater lifting and Circulation)
  - Chemical injection skid

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Operational sequence

- **Step 1**: Shut-down and depressurization via SSU
- **Step 2**: Inertisation (with Nitrogen)
- **Step 3**: Flooding and by-pass of the SSU
- **Step 4**: Progressive cleaning program
- **Step 5**: Intelligent pig run
  - Get quality data!!
- **Step 6**: Re-start of production
Conclusions

- Operational pigging IS part of pipeline integrity management
- Subsea & Deepwater conditions emphasize pigging operation constraints
- Subsea pigging:
  - Has to be anticipated in Design phase
  - Generates complex & risky operation
  - Requires additional time and loss of production with cost impact

Thank you !!!

Questions?

Pazflor SPL Animation by STAT-marine Engineering