Technical Session
Proactive Project Management Approach to Achieve Early Gas Production by Interim Jumper Hose Solution

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Layang Development Concept – Original

Layang Field Development Concept
- Unmanned wellhead platform is installed in Layang field
- Leased FPSO is installed in between HIP and LWP
- Full well streams from Layang wells are diverted to FPSO (Helang wells also can be diverted to FPSO)
- Gas is conditioned and compressed on FPSO, and finally comingled with HIP export gas
- Condensate / Crude mixed liquid is to be exported via tanker from FPSO
Layang Development Schedule – Original:

<table>
<thead>
<tr>
<th>Time Frame</th>
<th>Activities</th>
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<tbody>
<tr>
<td>2014</td>
<td>Mar FDP Approval</td>
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<tr>
<td></td>
<td>May Award of FPSO EPCIC and LWP EPCC Contract</td>
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<tr>
<td>2015</td>
<td>Mar Award of Pipeline EPCIC</td>
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<tr>
<td>2015</td>
<td>Oct LWP Installation</td>
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<tr>
<td>2016</td>
<td>Mar FPSO / Pipeline Installation</td>
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<td>Jun Commercial Production from FPSO</td>
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- FPSO Delivery was delayed from original schedule
- High gas demand for 2017 onward
- Alternative solution was required
Interim Jumper Hose Connection

- Manufacturing and installation of Jumper Hose to connect 11" pipeline and 13" pipeline
- HIP topside piping modification to receive gas from LWP
- Gas is sent to HIP topside process facilities from LWP Wells
# Contingency Plan Implementation:

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<tr>
<th></th>
<th>2015</th>
<th>2016</th>
<th>2017</th>
<th>2018</th>
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<tbody>
<tr>
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<td>Q1</td>
<td>Q2</td>
<td>Q3</td>
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<tr>
<td>FPSO EPCIC</td>
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</table>
| by original contractor | | | | | Original First Production target
| LWP Installation |      |      |      |      |
| In-house feasibility studies |      |      |      |      |
| Approval of Jumper Hose |      |      |      |      |
| Jumper Hose Manufacturing |      |      |      |      |
| HIP Topside Modification |      |      |      |      |
| 1st Gas Achievement |      |      |      |      |

### Success

Successfully mitigated delay of first production within one year

- **Over pressure protection**
- **Flow Assurance**
- **HIP Modification**
- **Multi-Diameter Pipeline**
- **Route selection**

- Re-arrange manufacturing slot.
- Manufacture additional 1 nos 11” to 13” End-fitting
- Utilize riser material

- DSS Spool pipe
- DSS Shutdown valve
Keys of Success

- Close collaboration between JXN PMT, its joint venture partner – PCSB and MPM-PG enabled the change management to be successful
- Support of Contractors who are capable to implement the changes of project within stipulated time successfully
- Proactive project management team to assess the risk of project delay and execute the contingency plan timely to minimize further impact
THANK YOU
Back Up
Technical Highlights: Over Pressure

Overpressure Scenario and Protection:
1. Inadvertent closure of valve at HIP topside
2. Pressure build-up in pipeline and trigger shutdown logic (Pressure High High) at LWP topside
3. Closure of Shutdown Valves at LWP topside to protect against well shut-in pressure

Design Verification:
- Closure Speed of Shutdown Valve
  - Final pressure after shutdown valve closure = 43.3 barg < 45 barg ⇒ OK
    (Pressure build-up speed in pipeline = 0.11 bar/sec, Shutdown Valve Closure Time = 12 sec)

- Reliability of Shutdown Logic against Failure Rate on Demand (SIL study)
  - Required reliability level for shutdown loop = SIL-3
  - Designed reliability level for shutdown loop = SIL-3 ⇒ OK
Technical Highlights: Flow Assurance

Flow Assurance Analysis for Jumper Hose Mode
- Steady State Analysis to confirm production rate
- Dynamic Analysis to check slugging behavior

HIPPS set pressure = 42 barg
Max Op P = 38 barg
Technical Highlights: HIP Modification

Modification of HIP process facilities
- To allow reverse flow with valve operation and turning over Check Valve
- To change pipe spool and SDV material from carbon steel to Duplex stainless steel and adding additional injection point to protect the CS pipe from HIP from CO2 corrosion.
Technical Highlights: Multi-diameter pipeline

Multi-diameter pig design
• To allow pigging operation through different inner diameters

Multi-diameter End-fitting design
• To connect 11 inch ID Jumper Hose to 13 inch ID Flowline
Technical Highlights: Route Selection

Route Selection
• To route the jumper hose connection in consideration of FPSO mooring laydown area and future re- reinstatement of original pipeline configuration