Riser Integrity Management

HSE Flexible Pipe Integrity Forum

November, 2008, Aberdeen

Technip
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Main Steps of Riser Integrity Management

First Year

Study Basis of Design
Inspection & Monitoring Programme Definition
Inspection & Monitoring Programme Execution
Post-processing of riser data and conclusions about riser integrity

Programme Preparation Onshore
Offshore Operations
IM Post-Processing Onshore

Year N +1

Task 1  Task 2  Task 3  Task 4
## Responsibilities

<table>
<thead>
<tr>
<th>Task 1 &amp; Task 2</th>
<th>Operator</th>
<th>Riser Manufacturer / Installer</th>
<th>RIM Service Provider</th>
<th>H&amp;S Provider</th>
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<tbody>
<tr>
<td></td>
<td>Specify</td>
<td>Provide Relevant Info</td>
<td>Establish RIM Programme</td>
<td>Provide Hardware, Software</td>
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<td></td>
<td>● Design</td>
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<td>● Manufacturing</td>
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<td>● Installation</td>
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<td>● Commissioning</td>
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<td>Integrate hardware in Riser</td>
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<td>FMA</td>
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<td>Task 3</td>
<td>Provide Additional Data from System</td>
<td>Manage, Analyze data</td>
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<td>Task 4</td>
<td>Act on Results</td>
<td>Integrity Assessment</td>
<td>Interprete Data</td>
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<td>Implement Recommendations</td>
<td>Make Recommendations</td>
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Dalia – RIM SCOPE

- **What**: Monitoring, testing & inspection of 8 IPB risers, 2 GI & 4 WI risers
- **Where**: On Dalia flexible risers –
- **How long**: During the entire field life
- **How**: Annual review of data & yearly follow-up report delivered to the Client + Annual optimization and adjustments of the schedule + regular general interaction with asset
Involved Parties

- Operator: Total

- RIM Service Provider: Genesis (Technip)

- Riser Manufacturer & Installer: TechnipFrance / Flexifrance

- H&S Providers:
  - Schlumberger: DTS system inspection & maintenance
  - Force Technology: Vent Gas Monitoring system maintenance
Dalia RIM: Services Overview

Operating Conditions Surveillance
- P,T enveloppe
- Peaks & shut-down
- DTS

Annulus Integrity Monitoring
- Vacuum tests
- Vent system check-up
- Peaks & Shut-down

External Integrity Surveillance
- ROV & visual insp
- DTS

Insp. & Maint. Of Monitoring System
- VGM
- DTS
- ...

Riser IM

Riser Mechanical & Plastic Ageing
- Vent gas analysis
- Polymer coupon
- Plastic ageing analysis
- Fatigue analysis
2008 Programme Review

- Inspection & maintenance on FPSO:
  - DTS system: Completed by Schlumberger
  - Vacuum tests & topsides inspections by Flexifrance:
  - VGM system maintenance: Force Technology

- Vent gas analysis: Performed in June 2008 – Conclusions issued in the Yearly Report

- Yearly Report: To be issued in December 2008 / January 2009

Key points:
- Importance of strong relationships between key players (knowledge transfer, access to in-house experts)
- Initiate early discussion
- Data gathering is key
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Flooding Annulus Detection

- Perform regular inspections to detect possible water ingress
  - vacuum test
  - N2 Gas injection and control of the injected volume

- Perform regular subsea examination

- Gas venting monitoring device
  - Measure any sudden increase in the gas flowrate
  - Presence of water at the venting ports

- Implement PIM (pipe integrity management)
  - P & T° history
  - Fluid history
  - Annulus history
Distributed Temperature Sensing (DTS) technology:

- ‘Raman Reflectometry’ (OTDR, analysis of back-scattered light)
- Continuous temperature profiles along each fibre with a resolution of 1m and very good accuracy (+/- 0.5°C) and resolution about 0.1°C
- Integration in the Flexible Pipe Manufacturing process:
  - SS tubes integrated in Flexible Pipe Manufacture (Armour layer or bundle)
  - Optical fibre inserted inside SS tubes
Temperature Monitoring: 

- Good Sensitivity of system

- Calibration of model to forecast temperature in different elements of Pipe.

- Applications
  - Flow Assurance
  - Annulus Flooding
Curvature Sensor

- ‘subC Rods’: based on Optical Fibre FBG sensors
  - GRP rod with 4 optical fibres
  - Sensors at about 1m (or less) intervals
- Integration in Bend Stiffener
  - 4 moulded voids included in design
- Calibration of System
  - Solutions have been developed
Acoustic Emission of wire Rupture

- Used on Full Scale test Several times
  - 2002 Tensile test on the traction bench in LeTrait
  - 2007 Corrosion Fatigue test

- Additional work ongoing to qualify for Offshore use.

- Calibration, fixation and location on flexible pipe needs close collaboration
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CONCLUSIONS

Complex process
- Many players
- Many interfaces

Technip view:
- Integrate under Company an Overall Service
  - To add value to the process
  - To deliver asset life expectations

Each player needs to fulfill its role
- Flexible Manufacturer (in particular access to in-house expertise)
- Monitoring Hardware/Software Supplier
- RIM Service Provider (at start and during lifetime - importance of historical events recording)
- Operator