Annulus Integrity Management - A New Approach

Presentation By:
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Presentation

- Introduction to flexlife & AGR
- Typical failure modes of flexibles
- The most common failure mode
- Current state of the art
- The ‘real’ state of the art
- Annulus assessment
- Fix
- Operate
- Annulus scanning R&D
flexlife and AGR

- flexlife independent flexible pipe consultancy
- Project Management of flexible pipe projects
- Integrity Management of flexible pipe assets

AGR - leading provider of integrity services and technologies to the international petroleum industry

Field Operations Group

Specialist inspection of flexibles, rigids, trees, FPSOs, etc.
Typical failure modes of flexibles

1st - Outer Sheath Damage
- Burst
- Installation Damage
- Abrasion Damage
- Dropped object

2nd - Aged Internal Sheath
- Mainly PA11 (Industry JIP $1000,000’s)

3rd - Internal Sheath Pull Out
- Mainly affected 1 grade of PVDF
- Obsolete through design/materials
The most common failure mode

- Small hole leads to:
  - Seawater flooded annulus
  - Accelerated general corrosion
  - Corrosion fatigue
  - Snapped wires
  - Can cause pipe failure

- Service life of flooded dynamic risers can be reduced significantly
- Has resulted in pipe failure
Current state of the art

- Annulus testing
  - Positive Pressure
  - Vacuum testing (most popular)
  - GVI (General Visual Inspection)
- Require access to topside endfitting
- Results are an indication of flooding only
- Neither method can with accuracy determine the extent of any water in the annulus
- Neither method can determine the consequences of any water in the annulus
Neptune scanning of flexible pipes for flooding
- ROV deployable
- 100% accurate
- 1 minute scan

Neptune scanning of flexible pipes for snapped, disorganised, corroded, or pitted wires
- ROV deployable
- 0.1mm accuracy
- 1-3 hours 500mm wide full circumference high resolution scan (resolution and OD dependent)
The ‘real’ state of the art

- Neptune 180kg in air
- Neutrally buoyant
- Designed to interface with work or inspection class ROV
- Can be orientated at any angle (risers - vertical)
- Self contained electronics and hydraulics
- Requires only power from ROV
The ‘real’ state of the art

- UT based technology
- Technology developed for flexible pipe
- Probe is not in contact with pipe
- Riser scanned real time and data recorded for further study
- 2 Cameras to record probe position so that any defect can be referenced to the scan and the pipe
- 1 hour to scan 500mm wide full circumference
The ‘real’ state of the art

- Accurately determine water in annulus
- Extent of permeation or seawater flooding
- Determine outer armour wire thickness to 0.1mm accuracy
- Scan for snapped wires
- Scan for disorganised wires
Annulus assessment

- Ascertain annulus integrity
  - Using Neptune scanning
  - Or traditional methods
- Find hole
  - Visual
  - Annulus injection of dye
- Scan discrete locations
  - Hole location
  - High fatigue locations
- Determine wire integrity
  - Snapped wires
  - Remaining wire thickness
Fix

- Stop oxygenated seawater ingress
- Permanent Repair of Annulus
  - Self repairing dynamic clampROV
    Deployable Uses Brinker Technology
    Plasma
  - Modular repair any length of breach

- Seal I/J tube
  - Evacuate
  - Fill with oil or inert gas
  - Inject TROS into annulus
Operate

- Corrosion level is known
- Oxygenated corrosion is stopped
- Further corrosion assessment is accurate and based on empirical data
- Service life assessment is therefore much more accurate
- The aim is to reduce the risk of failure as well as premature shut downs
Annulus scanning - R&D

- Surface Pitting Images
- Real Time permanent monitoring
  - Collars fitted to risers
  - Instantly tell you when the riser is flooded
- Challenge is battery life
- Annulus Scanning in I/J tubes
Questions?

www.agr.com
www.flexlife.co.uk